











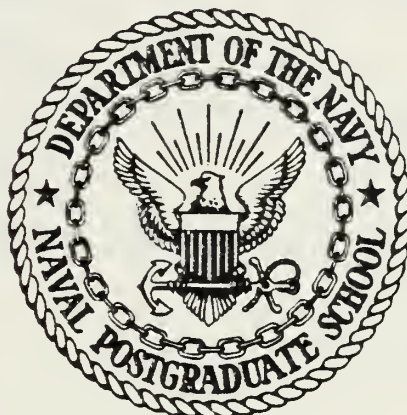






# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



# THESIS

AN ANALYSIS OF COLA ALLOCATION WITHIN  
THE UNITED STATES COAST GUARD

by

Kevin G. Ross

September 1983

Thesis Advisor:

P.M. Carrick

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The United States Coast Guard

by

Kevin G. Ross  
Lieutenant, United States Coast Guard  
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Submitted in partial fulfillment of the  
requirements for the degree of

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## I. INTRODUCTION

### A. IDENTIFICATION OF THE AREA OF INVESTIGATION

An important economic goal of the United States Coast Guard is to expend funds allocated by Congress in such a manner so as to achieve and maintain high standards of performance in all assigned missions and duties. An important step in attaining this goal is the efficient internal allocation of funds within the appropriation category of Operating Expenses. The financial accounts which distribute the funds in this appropriation at the Headquarters level are termed Operating Guides and are listed below with the operating funds that they are responsible for:

- (a) OG-30 Operating and Maintenance
- (b) OG-41 Aviation Maintenance
- (c) OG-42 Electronic Maintenance
- (d) OG-43 Structure Maintenance
- (e) OG-45 Vessel Maintenance
- (f) OG-46 Ocean Engineering Equipment
- (g) OG-54 Small Arms and Ammunition
- (h) OG-56 Personnel Training
- (i) OG-57 Medical Equipment
- (j) Fuel A Special Case
- (k) OG-01 Housing and General Mess
- (l) OG-20 Travel and Transportation (PCS)



The impact of inflation during any one year is not uniform throughout the economy, and since these individual accounts concentrate on different sectors of the economy they may encounter different rates of inflation. Each year the Coast Guard receives a lump-sum cost of living adjustment, COLA, for use in the approaching fiscal year. It is based on the anticipated rate of inflation as estimated by the Office of Management and Budget (OMB). Presently, the funds are internally allocated within the Coast Guard in a manner whereby each operating guide receives an identical percentage increase to its non-pay expenditure base from the previous fiscal year. This percentage is equal to the COLA rate provided by OMB. Although each account receives the same percentage of COLA, some accounts may see a greater erosion of their spending power in comparison to other accounts. The Office of Programs (G-CPA) at Coast Guard Headquarters requested that a study be conducted to determine if a method could be developed that would allocate the COLA funds in a manner whereby each account is allocated an equal amount of funds based on its estimated inflation rate.

The objective of this thesis is to propose a method as described above, and also show any differences between the COLA obtained and the COLA actually needed to totally counter the effects of inflation.

To provide the reader with necessary background, the remaining sections of Chapter I will investigate theory





behind budgeting for inflation and price indices. Chapter II will provide background on the Coast Guard's budget system, and some of the figures involved. Chapter III contains models for each operating guide, and Chapter IV uses these models to determine the cost-of-living for each account. In Chapter V each cost-of-living measure is used as part of a model which allocates the COLA funds to the twelve operating guides.

#### B. BUDGETING FOR INFLATION

In order to perform in an efficient manner every agency and firm, be it private or public, big or small, must develop a method of resource planning and allocation. A budget is of major importance in this planning as it shows the distribution of dollars to the different divisions within an agency or firm. A misallocation of funds within any agency can lead to less profit, unemployment, and poor performance by both personnel and equipment.

A budget is both a record of the past and a statement about the future plans and goals of an agency, as it links past and proposed expenditures. To accomplish this linking, proposals, or strategies are developed which represent an organization's expectations and aspirations [Ref. 1: pp. 4]. Based on these strategies dollar resources are allocated to the various goals of the agency. As the rate of inflation affects various industries in different ways part of this dollar allocation plan is the task of measuring inflation.



During the 1970's an increasing inflation rate overtook the nation, and severe steps had to be taken to understand and limit the effects of the rising prices. These steps usually include a method of predicting an anticipated rate of inflation on which to base allocations on. Unfortunately, this anticipated rate is not always the same as the subsequent real rate of inflation. As the budget is executed and actual inflation is experienced, it is important for the agency to perform appropriate measurements to correct for any misallocations [Ref. 2: p. 2].

To reflect the rate of inflation that an individual agency expects to experience, the agency can disaggregate the budget and then match these budget categories to appropriate inflation measuring factors. Usually the level of disaggregation that an agency uses will depend on the commodities that they purchase and the inflation measures available. The important feature in predicting the impact of inflation on an agency involves representing the essential elements and missions of the agency and their interaction with the economic environment [Ref. 3: p. 35]. By theory, disaggregation should continue until the commodities and services have been divided into  $m$  mutually exclusive and exhaustive subsets within which the behavior of prices and changes in prices are similar and stable [Ref. 4: p. 27]. It is important that the market baskets developed through the disaggregation, represent the commodities and services used in performing the agency's missions and operations.



Over the years, economists have developed various models for predicting the effects of inflation on different segments of the economy. Familiar and useful measurements of inflation are the cost-of-living indexes, such as the Consumer Price Index [Ref. 5: p. 146]. These indices may be only approximations, but they are a highly useful tool for quantifying the degree of inflation experienced by the entire economy.

In this thesis two basic indexes are used, the Producer Price Index series (PPI), and the Consumer Price Index series (CPI). With the use of these two inflation measuring factors, market baskets are produced for the twelve operating guides within the Coast Guard.

Since these two index series will be utilized, the next section will deal with basic theory of price indices.

#### C. THEORY OF PRICE INDEXES

In general, an index is a ratio of one quantity to another, and expresses this ratio in terms of its value relative to a base period's value. Therefore a price index measures changes in the price of an item by forming the ratio of the price in one period to the price of that particular item in a different period of time, usually the base period.

An initial step in developing a price index is to select a market basket of commodities and services whose price measurement the price index is being designed to calculate.





The simplest form of a price index is one that involves only a single item, but this is too limited where the concern is over a market basket of many goods. At this point an aggregate price index must be developed.

At first, one may consider a simple averaging over the price indexes of the individual commodities and services. But such a technique would be affected by extremes and give heavier weights to those items that experience a large increase or decrease in prices between the selected periods. A suitable index is made of two main parts, the price relative and a corresponding set of weights.

The price relative is the ratio of prices between two periods for each item.

$$\frac{P_{1i}}{P_{0i}}$$

where 0, 1 are the two periods and i represents the individual items. Multiplying this equation by the appropriate quantity for each item (same quantity in each period), we obtain the inflation factor for each item [Ref. 6: p. 20]. Summing over all items we obtain the inflation rate for a given bundle of goods  $Q_0$ .

$$\frac{P_1 Q_0}{P_0 Q_0} \quad (\text{summed over } i \text{ goods})$$



Another method of obtaining this same equation is to multiply the price relatives of each individual item by the proportion

$$\frac{P_{0i}Q_{0i}}{\sum_i P_{0i}Q_{0i}}$$

This quantity is the expenditure of each good  $i$ , divided by the total expenditure for period 0, and is a weighting factor representing each individual good's expenditure in relation to the total expenditure. Multiplying the weights by the price relatives and then summing over all items produces the same format as before.

$$\frac{P_1Q_0}{P_0Q_0} \quad (\text{summed over } i \text{ goods})$$

This equation represents a fixed-weight, fixed-base index termed the Laspeyres Index, developed by Etienne Laspeyres in 1864 [Ref. 7: p. 23]. In this equation, the numerator represents the market basket expenditure at current prices. The denominator represents the expenditure on the same commodities at the base period's prices. This type of index informs the consumer of how much relatively more it will cost him/her to purchase a base year market basket in any subsequent year.

Another commonly discussed price index is the Paasche Index, developed by H. Paasche in the year 1874 [Ref. 8: p. 24].



$$\frac{P_1 Q_1}{P_0 Q_1} \quad (\text{summed over all items } i = 1, N)$$

The Paasche Index uses current period quantities,  $Q_1$ , as weights, and is a ratio of the current period expenditure to a base expenditure based on the current period's quantity of goods. This index informs the consumer of how much it will cost to purchase a present market in the current period relative to the amount that same basket cost in the base period.

Price indices are also found in other forms, some of which are: [Ref. 9, p. 9]

(a) geometric average of the Laspeyre and Paasche indexes.

$$100 \left( \frac{P_1 Q_0}{P_0 Q_0} \cdot \frac{P_1 Q_1}{P_0 Q_1} \right)^{1/2}$$

(b) different forms of the average.

$$\frac{100}{2} \left( \frac{P_1 Q_0}{P_0 Q_0} + \frac{P_1 Q_1}{P_0 Q_1} \right)$$

$$100 \left( \frac{[Q_0 Q_1]^{1/2} P_1}{[Q_0 Q_1]^{1/2} P_0} \right)$$

(c) Marshall-Edgeworth formula.

$$\frac{100 (P_1 (Q_0 + Q_1))}{(P_0 (Q_0 + Q_1))}$$



Although these indexes are of different mathematical forms, they are similar in that they relate expenditures of one period to that of another period.

A composite index can be formed by using the Laspeyres form of the price index [Ref. 10: pp. 10-11]. The composite form of the index is as follows:

$$100 \left( \frac{(P_1/P_0) P_0 Q_0}{P_0 Q_0} \right)$$

Denoting  $100P_1/P_0$  for each item by  $r(i)$  and  $P_0(i)Q_0(i)/P_0Q_0$  by  $w(i)$  one obtains  $r(i)w(i)$ , summed over all  $i$  [Ref. 11: p. 11]. In this equation  $r(i)$  is the price relative of the  $i^{\text{th}}$  item, and  $w(i)$  is the weight for the  $i^{\text{th}}$  item. This weight is the proportion of an item's expenditure to the total expenditure of the consumer group. The formula for the price index in this form is

$$\frac{\sum r(i)w(i)}{\sum w(i)}$$

The weights are usually expressed so that their summation is one [Ref. 12: p. 11]. This form is useful for allowing agencies to develop their own indices as will be demonstrated in forming market baskets and a predictive model.

The Consumer Price Index (CPI) is a measure of the average change in prices over a period of time for a fixed basket of goods and services. There are two population





groups for which the CPI is now published. CPI-U is a new index which covers approximately 80 percent of the total noninstitutional civilian population [Ref. 13: p. 81]. The other index is for Urban Wage Earners and Clerical Workers (CPI-W), which represents about half the population covered by CPI-U [Ref. 14: p. 81]. In calculating either index, weights are assigned to listed items in accordance with their importance as measured by the appropriate population group's spending patterns. Changes in prices of various commodities and services from different locations are averaged together with their weights to produce the index [Ref. 15: p. 81].

Another index of importance, that is published on a monthly basis, is the Producer Price index series. This index is considered to be a general purpose index designed to measure changes in the general price level in all markets except for retail [Ref. 16: p. 109]. Most of the prices are the selling prices of representative manufacturers or producers, but some prices are those quoted on organized exchanges or at central markets [Ref. 17: p. 110]. The Producer Price Index series covers primary markets of the United States such as manufactured and processed goods, output of industries classified as manufacturing, agriculture, forestry, fishing, mining, gas and electricity, public utilities and goods competitive with those made in the producing sector, such as waste and scrap material. These



indexes are calculated in a manner similar to the method used on the Consumer Price Indexes.

These two index series are of great value in determining the inflation rate in different sectors of the economy. Their use will be demonstrated in Chapter III, when cost-of-living indexes are developed for each operating guide.

The next chapter outlines the Coast Guard's budget system and gives the reader an insight into the functions of the operating guides.



## II. THE COAST GUARD BUDGET

### A. THE SYSTEM

The budget of the United States Coast Guard is based on a planning, programming, and budgetary cycle that begins anew every twelve months. This 'budget cycle' consists of a sequence of events that require thirty-four months for completion. Due to the period of time for the cycle, several budgets will be in varying degrees of development at any given point in time. A budget begins its lengthy process in the planning stages of the PPB cycle in early February of BY+2. (BY+2 means two years before the budget year (BY), which is the annual budget that has been submitted to higher levels for review, authorization and appropriations.)

Therefore at the BY+2 stage, the budget is some thirty months away from appropriation. At this time the Commandant states his goals and priorities for the Coast Guard through a document entitled "The Long Range View." This document initiates the budget process, providing a common foundation in which objectives and policy framework are given for which to base planning for the future on. "The Long Range View" is divided into two sections, the 'overview' and the 'forecasts.' The overview gives a general discussion of the relationship between the Coast Guard's missions, facilities, and personnel; and external changes in national programs and





policies. The forecasts section documents the Coast Guard's formal objectives and considers responses to future events and trends that may impact heavily on the Agency.

In late February of BY+2, Operating Program Plans are submitted by Program Managers to the Office of Planning Evaluation (CPE). Table 2-1 outlines the operating program areas within Coast Guard Headquarters and what Operating Program Plans are required to be submitted. These Program Plans reduce the Long Range Views twenty-five year forecasts to a more predictable ten year planning horizon and are intended to bridge operational activities with planning and programming efforts. This allows the Program Managers to

TABLE 2-1  
OPERATING PROGRAMS

<u>OPERATING PROGRAM AREA</u>	<u>OPERATING PROGRAM PLAN</u>
SEARCH AND RESCUE	SEARCH AND RESCUE
AIDS TO NAVIGATION	SHORT RANGE AIDS TO NAVIGATION
OBSTRUCTIVE BRIDGES	BRIDGE ADMINISTRATION
MARINE SAFETY	COMMERCIAL VESSEL SAFETY RECREATIONAL BOATING SAFETY
MARINE ENVIRONMENTAL SAFETY	PORT AND ENVIRONMENTAL SAFETY MARINE ENVIRONMENTAL RESPONSE
OCEAN OPERATIONS	ICE OPERATIONS ENFORCEMENT OF LAWS AND TREATIES
MILITARY READINESS	MILITARY OPERATIONS/PREPAREDNESS
RESERVE TRAINING	RESERVE TRAINING



set appropriate levels for their operations and the resulting resource requirements.

Upon receiving approval on the Program Plans, the Program Managers now develop Operating Program Plan Summaries in mid-April. These summaries reduce the necessary planning and programming to a period of five years. The Plan Summaries are concerned with current shortages and the resources that are needed to reduce these shortages.

In June the Cutter, Boat and Aviation Plan, along with the Shore Facility Plan are submitted as outlined in Table 2-2. These three Plans list the resources needed for aircraft, vessels, and shore facilities in the various Coast Guard programs.

TABLE 2-2

FACILITY REQUIREMENTS/FACILITY PLANS RESPONSIBILITIES

<u>FACILITY</u>	<u>PROGRAM MANAGER</u>
SHORE FACILITIES REQUIREMENTS/SHORE FACILITIES PLAN	Chief, G-ECV
CUTTER REQUIREMENTS/ CUTTER PLAN	Chief, G-OP
AVIATION REQUIREMENTS/ AVIATION PLAN	Chief, G-OP

At the same time that the Operating Plans are being submitted and approved, Support Programs are going through the



same process. Table 2-3 shows the different plans submitted for General Support.

TABLE 2-3  
SUPPORT PROGRAMS

SUPPORT PROGRAM/PLAN

GENERAL ADMINISTRATION

PERSONNEL

ENGINEERING

FINANCIAL MANAGEMENT, PERSONNEL AND SUPPLY

RESEARCH AND DEVELOPMENT

HEALTH SERVICES SUPPORT

LEGAL SUPPORT

SAFETY AND OCCUPATIONAL HEALTH

CIVIL RIGHTS

PUBLIC AFFAIRS

INTELLIGENCE AND SECURITY

COMMAND, CONTROL AND COMMUNICATIONS

During August and September of BY+2, Determination drafts are submitted by Program Managers for both operational and support programs. The drafts are then reviewed, and in October, the Commandant issues the Determinations for the various programs to be included in the budget that is still twenty-four months from appropriation.

Determinations are a method through which the Commandant sets priorities for the appropriate budget. The submitted drafts set the agenda for discussions between the individual



Program Managers and the Commandant and his staff. Emphasizing concepts, Determinations set a priority listing of problems, not solutions. Through the use of these documents, the Commandant can give strategic guidance on those programs and/or activities that he feels are important and should be included in the budget. After the Commandant issues the final Determinations in October, the Program Managers review the documents and prepare appropriate Resource Change Proposals (RCP's) for submission in February and March of BY+1. The Resource Change Proposals are developed at the program level and are a basis for requesting and allocating funds. They are utilized as a format for guidance, approval, and selection and contain proposed solutions to various program problems. Any RCP submitted contains a preferred solution and at least three alternatives to a particular problem, and includes the net change in money and personnel that is required by each proposed solution. The costs (or gains) of each solution is provided not only for the budget year, but must be extended over a five year period in the future. Each RCP is scored based on a scoring and weighing algorithm which assigns a numerical grade to the RCP. Each RCP is scored many times, and as the priority setting process continues, individual RCP's must satisfy higher and higher standards to remain in competition for funding. Upon completion of the RCP scoring process, the Coordinating Board; consisting of the Deputy Chief of Staff (Chairman), the





Deputy Chief of Headquarters Divisions, Program and Support Managers, and the Chiefs of CPE and CBU; assembles to hear appeals on RCP's that failed to make the 'cut'. Any appeal must contain a statement describing the impact that the non-selection of this project will have on the Coast Guard. Based on recommendations from this Board, a draft of the 'Spring Preview Budget,' which is basically the surviving RCP's, is assembled. In June, the Spring Preview Budget is submitted to the Office of the Secretary of Transportation and the budget process goes outside the Coast Guard for the first time.

The budget that the Department of Transportation receives from the Coast Guard consists of an analysis of major changes in existing or new programs and gives an insight into the direction that the Coast Guard plans to take. In July, the Department of Transportation issues their policies in junction with the Coast Guard's budget and also issues dollar ceilings for the Service's budget. On receipt of the guidance, the Coast Guard must revise their priority list and budget figures to conform to DOT policies. In late July of BY+1, the Coast Guard's budget becomes part of DOT's budget which is submitted to the Office of Management and Budget (OMB) in September

In September and October, Coast Guard personnel appear before OMB hearings to defend the Service's OMB Stage Budget. Another set of guidance and dollar ceilings are issued by



OMB in early November. The next step for the Coast Guard is the preparation and submission of the Congressional Stage Budget for approval to become part of the President's budget.

Throughout the summer months of BY, the budget is reviewed by Congressional House and Senate Appropriation subcommittees and committees. In October, the beginning of this budget's fiscal year, the Appropriation Act is issued by Congress and the Operating Stage Budget is distributed by Coast Guard Headquarters. The Operating Stage Budget represents those funds that the Coast Guard has legal authority, as a federal agency, to spend over the course of the fiscal year. Table 2-4 is an outline of the budget cycle process for the Coast Guard.

Throughout the budget cycle, internal decision-making authority is that of the Commandant's, but the structure of the system also allows for inputs of information and recommendations from personnel up and down the chain of command. Table 2-5 outlines an interactive system where there is a formal dialogue between different levels.

When appropriations are received from Congress the following categories are used:

- (a) Operating Expenses
- (b) Acquisition, Construction, and Improvements (AC&I)
- (c) Alteration of Bridges
- (d) Retired Pay
- (e) Reserve Training



TABLE 2-4  
COAST GUARD BUDGET CYCLE

BY+2

FEBRUARY: Commandant Issues Long Range View  
MARCH: Submission of Program Plans/Standards  
APRIL: Submission of Operating Plan Summaries  
MAY: Commandant Issues Operating Plan Summaries  
JUNE: Submission of Support Plan Summaries  
JULY: Commandant Issues Support Plan Summaries  
AUGUST & SEPTEMBER: Submission of Determination Drafts  
OCTOBER: Commandant Issues Determinations

BY+1

FEBRUARY & MARCH: Submission of Resource Change Proposals  
APRIL & MAY: Scoring of Resource Change Proposals  
JUNE: Spring Preview Budget Submitted to OST  
JULY: OST Guidance Received. Budget Becomes Part of DOT's Budget  
SEPTEMBER: DOT Budget Submitted to OMB  
OCTOBER: OMB Hearings  
NOVEMBER: OMB Guidance Received  
DECEMBER: OMB Budget Finalized

BY

JANUARY: Submission of Congressional Stage Budget  
MARCH: House Appropriation Hearings  
JUNE: Senate Appropriation Hearings



TABLE 2-4 (CONT.)

SEPTEMBER: 2nd Concurrent Joint Resolution

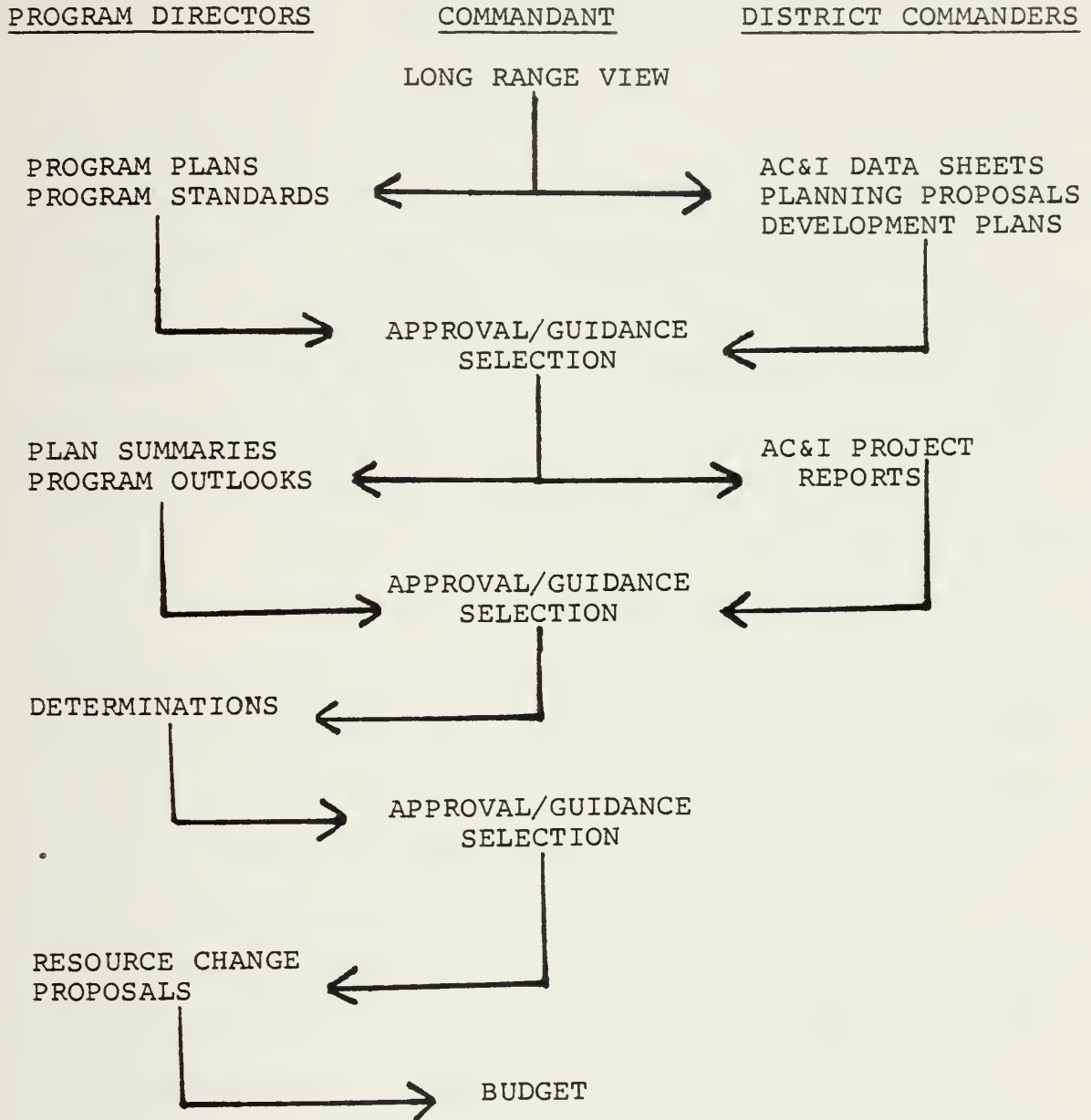
OCTOBER: Appropriation Act Issued by Congress.  
Operating Stage Budget Issued by the Coast  
Guard





TABLE 2-5

THE INTERACTIVE NATURE OF COAST GUARD PLANNING





- (f) Research, Development, Test and Evaluation
- (g) National Recreation Boating Safety and Facilities Improvement Fund
- (h) Offshore Oil Pollution Compensation Fund
- (i) Deepwater Ports Liability Fund
- (j) Oil Pollution Fund

Internally, there are three different classifications of money used; (1) operating expenses (one year money), (2) research and development funds (no year money), and improvement funds (AC&I), which is fixed year money. AC&I money is used for acquisitions of vessels (over \$125,000), acquisition of aircrafts, complete or partial renewal of vessels and aircraft (cost over \$125,000 and over 75 percent renewed), complete or partial renewal of structures (cost over \$125,000 and 75 percent renewed), and betterments costing over \$125,000 per aircraft, vessel, or structure. If these requirements are not met, the funding is from the operating expenses account, although operating expenses can not be used to augment any AC&I project.

While AC&I money is zero-based each year, the Operating Expense (OE) money is limited to follow-on money and is an incremental process, base plus an inflation adjustment.

The Operating Expense category, which is the main concern of this thesis, is further subdivided into operating program areas as follows:

- (a) Search and Rescue
- (b) Aids to Navigation



- (c) Marine Safety
- (d) Marine and Environmental Protection
- (e) Enforcement of Laws and Treaties
- (f) Ice Operations
- (g) Military Readiness
- (h) Headquarter Administration

Within the Coast Guard, Operating Expense funds used by the programs are accounted for on the basis of operating guides. Operating guides consists of those listed earlier plus OG-80 and OG-88 (Reimbursements), OG-08 (Civilian Pay and Allowances), and OG-90 (Reserve Programs Expenses). These four guides are not of a concern since they deal with pay and are affected by another inflation adjustment as provided by Congress.

In the budget process, operating expenses are funded on an incremental process. The previous year's base is fully funded, and then a line item for inflation is included. This inflation adjustment is the COLA received from OMB. Any further additional funds are for RCP's which have been approved and funds provided for. This inflation estimate applies only to non-pay costs in the operating expenses category. OMB Circular A-11 requires that all executive agencies plan any estimates for inflation allowances based on the OMB generated inflation rate. Further guidance is issued in A-11 as stated; "the policy of permitting consideration of price changes for goods and services, (other than



federal employee's pay), as a factor in developing the estimate, does not mean that an allowance for the full rate of anticipated inflation should be included in an agency's requests. While agency's totals approved by OMB will reflect consideration of the effect of inflation, they may include an allowance for less than the full rate of anticipated inflation or even no allowance for inflation" [Ref. 18]. This implies that although an agency may plan for the full rate of inflation, they may have to allocate based on a different, smaller rate.

## B. THE FIGURES

Although the budget planning cycle begins within the Coast Guard, the actual funding of programs starts with the Congress and their approval of various appropriation bills. It becomes important to understand where the Coast Guard is located in the overall budget set-up.

On the Department level, the Coast Guard is located in the Department of Transportation (DOT) from which they are allocated funds in accordance with a DOT budget. DOT in turn is allocated funds based on a national level budget. Tables 2-6 and 2-7 outline Budget Authority and Budget Outlays as distributed to the different Departments. The Department of Transportation was allocated approximately 2.6 percent of the total Authority and 2.7 percent of total Outlays in fiscal year 1982. Based upon projections to fiscal year 1987, DOT's share will decrease to approximately





TABLE 2-6

BUDGET AUTHORITY BY AGENCY  
(In Billions of Dollars)

Department	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)	1986 (Est.)	1987 (Est.)
Legislative Branch	1.4	1.5	1.6	1.6	1.7	1.7
Judiciary	.7	.8	.9	.9	.9	1.0
President	8.6	10.5	9.9	9.4	9.0	8.8
Agriculture	40.6	41.6	39.2	33.7	31.3	32.2
Commerce	1.8	1.6	1.4	1.4	1.4	1.5
Defense (Military)	213.8	239.4	273.4	321.6	356.4	383.3
Defense (Civil)	3.0	3.0	2.1	2.3	2.3	2.4
Education	14.7	13.8	13.1	13.1	13.1	13.1
Energy	7.9	8.4	8.9	10.7	10.6	11.0
Health and Human Services	246.2	273.0	285.2	320.8	353.7	386.9
Housing and Urban Development	20.1	10.7	4.1	4.6	8.7	14.8
Interior	3.7	3.8	3.4	2.9	2.5	3.3
Justice	2.6	2.9	3.4	3.4	3.2	3.3
Labor	27.2	38.1	36.3	34.9	35.3	35.5
State	2.6	2.7	2.9	3.0	3.1	3.2
Transportation	20.5	25.9	27.0	27.7	28.6	28.5
Treasury	111.3	118.2	135.1	152.4	167.5	179.3
Environmental Protection	3.7	3.7	3.6	3.7	3.7	3.4
NASA	6.0	6.8	7.1	7.0	6.3	6.3
Veterans Administ.	24.9	25.0	26.1	26.8	27.7	28.6
Personnel Management	32.6	36.0	38.3	43.5	45.3	47.4
Other Agencies	15.2	16.6	15.6	15.9	15.9	15.9



TABLE 2-7

BUDGET OUTLAYS BY AGENCY  
(In Billions of Dollars)

Department	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)	1986 (Est.)	1987 (Est.)
Legislative Branch	1.4	1.5	1.6	1.6	1.6	1.6
Judiciary	.7	.8	.9	.9	.9	.9
President	6.2	7.4	8.0	8.2	8.1	8.1
Agriculture	36.2	45.0	35.0	32.9	32.4	32.9
Commerce	2.0	2.0	1.7	1.6	1.5	1.6
Defense (Military)	182.9	208.9	238.6	277.5	314.9	345.6
Defense (Civil)	3.0	2.9	2.2	2.2	2.3	2.4
Education	14.1	14.4	13.5	13.4	13.0	12.9
Energy	7.6	8.7	8.8	9.6	10.1	10.7
Health and Human Services	251.3	274.4	288.8	312.6	336.2	363.0
Housing and Urban Development	14.5	14.9	13.7	12.8	12.9	14.0
Interior	3.9	4.0	3.6	2.9	2.4	3.3
Justice	2.6	3.0	3.3	3.3	3.3	3.3
Labor	30.7	43.0	34.3	30.5	28.9	28.0
State	2.2	2.3	2.6	2.7	2.8	2.9
Transportation	19.9	21.2	24.4	24.4	26.3	27.1
Treasury	110.5	118.0	135.0	152.2	167.2	179.0
Environmental Protection	5.1	4.4	4.1	4.0	3.8	3.6
NASA	6.0	6.7	7.0	7.0	6.4	6.3
Veterans Administ.	23.9	24.4	25.7	26.4	27.1	27.8
Personnel Management	20.0	21.5	23.2	24.2	25.9	27.5
Other Agencies	13.1	12.5	11.4	10.4	10.3	9.6



2.5 percent of the total in each category. The annual rate of change, for DOT, in Outlays is estimated to fall from a 15 percent increase between 1983-84 to a 3 percent increase between 1986-87. For Budget Authority this decrease will be from a high of 26 percent between fiscal years 1982-83 to a minus .3 percent between 1986-87.

This decreasing rate of growth will likely affect the Department of Transportation's goal of providing a U.S. transportation system that is safe, efficient, and economical in the movement of people and goods and in supporting the national defense. These goals are intrinsically in conflict, but especially so when funds are scarce which means that trade offs will have to be made between these three major goals. These changes on the national level will also affect the agencies within each Department. Table 2-8 shows the budget authority allocations and Table 2-9 shows the budget outlays allocations, for the major programs within the Department of Transportation. Ground transportation includes highway safety, mass transit, and railways; air transportation deals with airports, aeronautical research and technology, and air carrier subsidies; and water transportation includes ocean shipping, marine safety, and marine transportation. Generally, these programs are facing the same monetary situation as the Department is facing on the national level. The expected cutbacks in DOT's budget and their effect on various agencies is depicted in Table 2-10, which



TABLE 2-8

BUDGET AUTHORITY--MAJOR PROGRAMS IN DOT  
(In Millions of Dollars)

Program	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)
GROUND TRANSPORTATION	14,559	18,869	19,062	19,147
AIR TRANSPORTATION	3,785	4,806	5,692	6,142
WATER TRANSPORTATION	2,939	2,994	2,995	3,103
OTHER				

TABLE 2-9

BUDGET OUTLAYS--MAJOR PROGRAMS IN DOT  
(In Millions of Dollars)

Program	1982 (Actual)	1983 (Est.)	1984 (Est.)	1985 (Est.)
GROUND TRANSPORTATION	14,326	14,562	17,249	17,875
AIR TRANSPORTATION	3,564	4,222	4,884	5,173
WATER TRANSPORTATION	2,696	3,059	3,019	3,054
OTHER	90	120	118	173





TABLE 2-10

TOTAL FEDERAL FUNDS--DOT BUDGET  
(In Thousands of Dollars)

Agency	1982 (Actual)	1983 (Est.)	1984 (Est.)
FEDERAL HIGHWAY ADM.			
AUTHORITY	431,598	533,309	13,020
OUTLAYS	122,451	356,105	465,255
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION			
AUTHORITY	50,252	52,745	55,784
OUTLAYS	45,521	64,748	55,580
FEDERAL RAILROAD ADM.			
AUTHORITY	1,951,464	1,019,679	908,707
OUTLAYS	2,218,532	1,616,015	1,190,819
URBAN MASS TRANSIT			
AUTHORITY	3,532,238	3,566,166	2,665,166
OUTLAYS	3,864,234	3,818,330	3,487,970
FEDERAL AVIATION			
AUTHORITY	1,537,929	1,369,535	1,652,405
OUTLAYS	1,379,635	1,404,095	1,651,954
COAST GUARD			
AUTHORITY	2,525,522	2,465,126	2,544,447
OUTLAYS	2,077,060	2,462,075	2,571,734
MARITIME ADMINISTRATION			
AUTHORITY	434,150	525,234	511,513
OUTLAYS	650,830	597,747	509,403



shows the funds allocated to the major agencies within DOT. Of the total funds received by the Department, the Coast Guard is typically allocated 9 percent of the budget authority and 10.5 percent of the outlays. Of the funds allocated to the Coast Guard, approximately 64 percent is targeted for the important appropriation category, operating expenses.

In the final budget the Coast Guard actually receives 85 to 90 percent of funds requested in their initial budget. As the budget progresses through the different stages from the agency level to the congressional level, priorities are established at each level. As the sequence of priorities are established, the dollar figures within the Coast Guard's budget also changes as shown in Tables 2-11 and 2-12 for fiscal years 1983 and 1984. At each ascending level the dollars being funded at that level must be allocated to more units than at the preceding level. With funds being slashed at each level, individual budgets are being reduced.

Table 2-13 gives the allocation of funds within the Operating Expense category to the major programs. Search and Rescue, Aids to Navigation, and Enforcement of Laws and Treaties receive almost 70 percent of all funds being allocated with 26 percent, 22 percent, and 21 percent, respectively. These three programs make major use of aircraft and cutters, and receive a large amount of support from land stations. The use of these systems and the funds used by these programs is the link between the major program



TABLE 2-11

FY 1983 COAST GUARD BUDGET REQUEST  
(In Thousands of Dollars)

APPROPRIATION REQUEST TO:	DOT	OMB	CONGRESS
OPERATING EXPENSES	1,668,371	1,603,799	1,577,958
ACQUISITION, CONSTRUCTION, IMPROVEMENTS	417,000	396,300	284,820
ALTERATION OF BRIDGES	19,000	0	10,200
RETIRED PAY	310,000	310,000	319,500
RESERVE TRAINING	57,500	52,600	50,094
RESEARCH, DEVELOPMENT AND TEST AND EVALUATION	30,730	15,000	15,000
NATIONAL RECREATIONAL BOATING AND FACILITIES FUND	0	0	5,000
POLLUTION FUND	(7,000)	(7,000)	(7,000)
OFFSHORE OIL POLLUTION COMPENSATION FUND	4,500	1,000	1,000
DEEPWATER PORT LIABILITY FUND	1,000	1,000	1,000
SUPPLY FUND	0	0	0
TOTAL	2,508,151	2,379,699	2,264,572



TABLE 2-12

FY 1984 COAST GUARD BUDGET REQUEST  
(In Thousands of Dollars)

APPROPRIATION REQUEST TO:	DOT	OMB	CONGRESS
OPERATING EXPENSES	1,744,084	1,713,697	1,687,542
ACQUISITION, CONSTRUCTION, IMPROVEMENTS	685,000	453,427	378,600
ALTERATION OF BRIDGES	22,700	13,200	13,200
RETIRED PAY	351,900	351,900	341,300
RESERVE TRAINING	59,079	56,106	54,805
RESEARCH, DEVELOPMENT AND TEST AND EVALUATION	25,000	25,000	22,000
NATIONAL RECREATIONAL BOATING AND FACILITIES FUND	5,000	5,000	4,500
POLLUTION FUND	7,000	7,000	7,000
OFFSHORE OIL POLLUTION COMPENSATION FUND	1,000	1,000	1,000
DEEPWATER PORT LIABILITY FUND	1,000	1,000	1,000
SUPPLY FUND	80	80	80
TOTAL	2,901,843	2,672,410	2,551,527





TABLE 2-13

OPERATING EXPENSES FUNDS  
(In Thousands of Dollars)

PROGRAM	1982 (Actual)	1983 (Est.)	1984 (Est.)
SEARCH AND RESCUE	397,124	422,735	436,066
AIDS TO NAVIGATION	341,163	360,438	369,321
MARINE SAFETY	127,974	125,202	127,260
MARINE ENVIRONMENTAL PROTECTION	145,365	152,431	159,507
ENFORCEMENT OF LAWS AND TREATIES	306,199	332,309	359,039
ICE OPERATIONS	86,717	56,712	58,106
MILITARY READINESS	77,321	81,459	84,634
HEADQUARTERS ADMINISTRATION	-	75,140	93,610
TOTAL	1,481,863	1,606,426	1,687,542



appropriations and the internal allocation and control of funds through the operating guides. The funds are controlled by the operating guides, and as resources are used by the programs, funds are charged to the programs for accounting purposes. An example of this is in fiscal year 1980, where the primary areas for cutter employment were search and rescue (17.2%), enforcement of laws and treaties (9.4%), and aids to navigation (8.6%). For aircraft the primary areas for the same year were search and rescue (27.9%), enforcement of laws and treaties (3.3%), and training (2.6%). To keep the cutters and aircraft operational, funds from the different operating guides, such as OG-45 (vessel maintenance), OG-41 (aviation maintenance), and OG-30 (fuel) are used. In this way the resources are made available to carry out the missions of the major programs. In dealing with its major systems the Coast Guard is facing some stringent cost problems. In fiscal year 1980, there was a maintenance backlog for cutters of some \$506.7 million for machinery and structural deficiencies, \$89.1 in habitability deficiencies and \$9.8 million in allowance and parts deficiencies [ref. 19: p. 677]. At the same time maintenance cost per hour for aircraft increased some 59 percent between 1979 and 1984, and fuel costs per hour has increased by some 231 percent [Ref. 20: p. 654]. The impact of rising prices on aircraft maintenance can be demonstrated by cost and usage rates in 1980 [Ref. 21: pp. V-VI]:



<u>PLANE TYPE</u>	<u>COST</u>	<u>UTILIZATION RATE</u>
HC-131A	+28%	-19%
HC-130B/H	+32%	0
HH-52A	+22%	- 1%
HU-16E	-34%	-16%
HH-3F	+22%	(slightly)
VC-11A	+ 4%	-10%
VC-4A	+44%	-22%

Costs are rising and usage is decreasing as prices continue to rise. As inflation continues to grow and systems grow older, the allocation of funds to those areas that require additional funds becomes very important.

This chapter has outlined reasons why the proper allocation of funds to the operating guides is necessary and desired. The next chapter deals with the development of individual models for each account and is the first step in a process to accomplish the above task.



### III. ANALYSIS OF THE OPERATING GUIDES

#### A. METHODOLOGY AND ASSUMPTIONS

The initial step in the development of a model to allocate the COLA funds to the operating guides, is to estimate the rate of inflation that has been experienced by the individual accounts. To accomplish this, market baskets have been developed that represent the commodities and services that the account purchases. The market baskets were developed by determining the commodities and services that are used by the accounts and then by determining inflation rate factors to act as proxy variables. Weights were then assigned to these variables to represent the percent of total funds that was spent on that good. Since this is the first time that the Coast Guard has attempted to produce market baskets for each account, there was a lack of suitable data. Spending by Object Codes was investigated, but because of the manner of the data and storage, suitable access to the data was not possible. Therefore to determine the market baskets and weights each operating guide manager was interviewed and his account discussed. Cost data was received for one or two years which highlighted the major cost items in each account. Also studies developed by other services and independent groups were investigated. With these resources, the author determined the commodities and services and assigned appropriate weights. In the weighting process, equal weights





were given to the products and services when data was not available. In areas where data was available, appropriate estimates of the weights were developed. It is important to realize that the weights express proportions of total expenditures, and that these proportions were developed through limited data, and limited knowledge of the entire market structure of each account.

The inflation rate factors that were chosen to act as proxy variables were the Consumer Price Index, Producer Price Index, and Average Hourly Earnings. They were selected because they represent a large number of products and services, and are easy to obtain as they are published monthly. For the CPI and PPI codes, the Bureau of Labor Statistics publishes seasonally adjusted data as well as unadjusted changes in a time period. Seasonally adjusted changes are usually used by those seeking to analyze general price trends in the economy, whereas unadjusted changes are of interest to those consumers wanting knowledge of the prices they are actually paying [Ref. 22: p. 82]. As unadjusted data is used for escalation purposes, they will be used in the execution of the individual developed models. The Average Hourly Earnings are also published monthly by the Bureau of Labor Statistics and is an indicator which covers straight time wage, overtime premiums and selected employee contributions [Ref. 23: p. 6].



Each individual model has a material section, and in cases where labor costs in the product industries are important and a suitable proxy is available, a labor section is included. Small arms, personnel training, housing, and fuel do not include a labor section as explained in the development of each model.

The weights are then assigned in each section so that they sum to one. This means that under the material section and the labor section, the weights will add to one. The weight assigned to materials and labor overall will also sum to one. The assignment of weights is important in that those indexes with a larger weight have a heavier impact on the calculations of the final index. If the commodities or services that make up the market basket have index measurements that are relatively the same, the weights can be interchanged without a great deal of impact on the final index. But if the indexes represent price movements that progress inversely to each other, any changes in the weights could have an impact on the final index [Ref. 24: pp. 37-38]. Appendix C contains graphs of the indexes used in each account. These are supplied to give the operating guide managers an indication of the impact of changing weights in his account.

It is assumed that the commodities and services chosen for each market basket represent the account and are a fixed basket. Since the accounts are made up of products for



maintenance, repair, and general upkeep, the same products should be purchased year after year. Changes in a market basket could arise from a change in technology. An example of this would be that of switching to nuclear power where different maintenance supplies would be required.

#### B. OG-30 OPERATING AND MAINTENANCE

Operating Guide 30 purchases a variety of goods and services from flags to fuel. The account is administered by the Office of the Comptroller in the Financial Branch (G-F), and is affected by the inflation rate in almost all sectors of the economic structure.

This account pays for administrative travel; rental of equipment such as Xerox machines; water, sewage, electricity, and other utilities used by Coast Guard units; printing and reproduction; telephone systems such as FTS, Autovon, and WATTS; leased equipment; rental of vehicles; and general administrative supplies. OG-30 is also responsible for general medical care and supplies, which includes the CHAMPUS program.

As this account involves many segments of the economy, a general index that measures inflation for the entire economy was determined to be the most suitable proxy variable. The overall Consumer Price Index is a composite index determined by food and beverages, housing, apparel and upkeep, transportation, medical care, entertainment, and other



goods and services. Since OG-30 is affected by each of these groups except food and beverage, the overall CPI index--less food will be used as the material section of the OG-30 index.

The labor section is an aggregate of four general Average Hourly Earnings (AHE) components, each weighted at 25 percent, that represent areas from which OG-30 purchases goods and services.

- (a) Manufacturing
- (b) Retail and Wholesale
- (c) Transportation
- (d) Services

In the final composite index for OG-30 both labor and materials are equally weighed at 50 percent.

#### C. OG-41 AVIATION MAINTENANCE

Operating Guide 41, controlled by the Office of Aeronautical Engineering (G-EAE), is responsible for procuring those items needed for the maintenance and repair of aircraft utilized by the Coast Guard. It is not responsible for the cost of fuel as fuel is purchased by OG-30, nor for the cost of some of the major electronic equipment which is purchased by OG-42. This account does purchase aircraft parts for repairs and overhauls, major components such as engines and rotors, life support equipment, technical services, ground support equipment, and avionics. G-EAE projected cost percentages are:





Aircraft Maintenance	71 Percent
Aircraft Overhauls	15 Percent
Avionics	8 Percent
Services	4 Percent
Ground Support Equipment	1 Percent
Training, Travel, Misc.	1 Percent

OG-41 has encountered large increases in cost, partially from a lack of adequate spares caused by the aging of major systems. This will be alleviated somewhat by the purchase of 41 HU-25 Guardian jets to replace the HU-16E seaplane, and the purchase of the HH-65A Dolphin helicopter to replace the aging HH-52A single-engine helicopter.

To determine OG-41's composite index various models were researched, including a Navy study on production flyaway aircraft escalation indexes, and the contract for the new Dolphin helicopter. The escalation clause in the Dolphin contract involved the use of indexes that were broadly defined. These indexes included the following producer price indexes, PPI for Industrial Commodities (for the Airframe material index), and the PPI for Electrical Machinery and Equipment (for Engine and Electrical material index). In contrast, the Navy study used a very detailed market basket, but emphasized costs that are important in the procurement of a system and not in the upkeep and repair of the system. From these two resources, plus an Army study, and input from Coast Guard personnel, three main cost areas were



identified, the airframe, the engine, and electronics. The following proxy variables and weights were decided on:

Materials (42 percent)

(a) AIR FRAME (62 percent)

PRI 1013-02 Finished Steel Mill Products (20 percent)

PPI 1013-0264 Stainless Sheets (10 percent)

PPI 1025 Mill Shapes (20 percent)

PPI 1143 Fluid Power Equipment (10 percent)

PPI 1081 Bolts, nuts, screws, rivets (10 percent)

PPI 101 Iron and Steel (30 percent)

In June of 1982 a new index appeared that will now be used in place of PPI 1081. It is PPI 1081-05, Aerospace Fasteners.

(b) ENGINE (19 percent)

PPI 101 Iron and Steel (60 percent)

PPI 1022-0128 Nickel, Cathode Sheets (10 percent)

PPI 1013-02 Finished Steel Mill Products (20 percent)

PPI 117 Electrical Machinery and Equipment (10 percent)

(c) ELECTRICAL (19 percent)

PPI 117 Electrical Machinery and Equipment  
(100 percent)

Labor (58 percent)

(a) AIR FRAME (50 percent)

AHE 3721 Aircraft Industry (60 percent)

AHE 3728 Aircraft Parts and Equipment (40 percent)



(b) ENGINE (20 percent)

AHE 3724 Aircraft Engine Parts (100 percent)

(c) ELECTRICAL (30 percent)

AHE 366 Communications Equipment (45 percent)

AHE 367 Electrical Components and Accessories  
(55 percent)

#### D. OG-42 ELECTRONIC MAINTENANCE

Operating Guide 42 is located in the Office of Telecommunications and Electronics (G-TPP), and is responsible for the procurement of components and other equipment needed for the repair and maintenance of electronic equipment used by the Coast Guard. This equipment includes anti-submarine warfare systems, including sonars and depth sounder equipment. Other equipment that OG-42 is responsible for includes radars, communication systems, computers, electronic antenna networks, and electronic support for cutters, aircrafts, and other units of the Service. In comparison to the other accounts, OG-42 probably has to be more aware of the available state-of-the art equipment.

There are four major cost categories to determine proxy variables and weights for.

(a) Major Electronic Equipment (transmitters, teletypes, receivers, radars)

(b) Electronic Structures and Circuits

(c) Command and Control Systems

(d) Operating Systems (software)



Producer price indexes selected to represent these cost categories are as follows:

PPI 1171	Wiring Devices (20 percent)
PPI 1172	Integrating and Measuring Instruments (20 percent)
PPI 1174	Transformers and Power Regulators (10 percent)
PPI 1175	Switchgear and Switchboard Equipment (10 percent)
PPI 1178	Electronic Accessories and Components (40 percent)

PPI's 1174 and 1175 represent the category of Major Equipment, as they include various types of transformers, receivers, and controls. PPI codes 1171 and 1172 represent Electronic Structures and Circuits, as they include various types of current devices, test equipment, and structures. PPI 1178 includes items for all four categories, but mainly represents the new state-of-the-art equipment such as computers.

The labor part of the electronic industry is represented by AHE 36, Electrical Equipment and Supplies. This is the only index used in the labor section.

In the final composite index, labor is weighted 60 percent and materials 40 percent.

#### E. OG-43 STRUCTURE MAINTENANCE

The Office of Civil Engineering (G-ECV) controls the funds allotted to Operating Guide 43. OG-43 is responsible





for the repair of buildings and structures throughout the Coast Guard. This includes repairing of moorings and pilings, rebuilding generators and electrical panels, installation and maintenance of CO2 systems, and the maintenance of living spaces and other buildings.

The proxy variables and weights selected were determined from research of the Engineer News Record Building Cost Index and Construction Cost Index. The Construction Cost index was designed as a general purpose construction cost index, and is a weighted aggregate index of structural steel, portland cement, lumber, and common labor. Because the index is designed to indicate basic underlying trends of construction costs in the United States, it uses materials that are least influenced by purely local conditions [Ref. 25: p. 116]. Steel, lumber, and cement were selected as they represent the most stable relationship with the nation's economy and its price structure [Ref. 26: p. 116]. The current construction cost index is:

- (a) Common Labor (74 percent)
- (b) Structural Steel (15 percent)
- (c) Lumber (2 x 4's) (9 percent)
- (d) Portland Cement (2 percent)

The current building index is made up of the following:

- (a) Skilled Labor (56 percent)
- (b) Structural Steel (26 percent)
- (c) Lumber (2 x 4's) (15 percent)
- (d) Portland Cement (3 percent)



Based on these two indexes, the following proxy variables and weights were selected in forming a market basket for OG-43:

Materials (44 percent)

PPI 10 Metals and Metal Products (59 percent)

PPI 08 Lumber and Wood Products (34 percent)

PPI 1322 Portland Cement (7 percent)

Labor (56 percent)

AHE 15 General Building (unskilled) (55 percent)

AHE 17 Special Trades (skilled) (45 percent)

F. OG-45 VESSEL MAINTENANCE

Operating Guide 45 is operated by the Office of Naval Engineering (G-ENE), and is responsible for the funding of repairs and maintenance of Coast Guard vessels. This includes the main propulsion plant, the hull, and the auxiliary equipment.

In developing the composite index, conversations were held with the Navy (NAVSEA 17) and the Maritime Administration (MARAD). Both of these agencies use a similar model in estimating ship procurement costs. The model consists of a material index made up of three indexes from the Producer Price Index series. They are PPI 101 Iron and Steel (45 percent), PPI 114 General Purpose Machinery and Equipment (40 percent), and PPI 117 Electrical Machinery and Equipment (15 percent). The labor index is developed from the wages



of 18 selected shipyards. In comparing the Coast Guard's maintenance attitude with those of the Navy and commercial business, there are differences to be found.<sup>1</sup>

	<u>NAVY</u>	<u>COMMERCIAL</u>	<u>COAST GUARD</u>
REDUNDANCY LEVELS	HIGH	MEDIUM	HIGH TO MEDIUM
ONBOARD SUPPORT	HIGH	LOW	MEDIUM
DEPLOYMENT	LONG	SHORT	SHORT
CREW ASSIGNED MAINTENANCE	HIGH	MINIMUM	MEDIUM

There are also differences in the major maintenance cycle, as the Navy's is shorter than the Coast Guard's. The average age of the vessels in the Coast Guard's fleet is twenty-seven years, although this will change with the addition of the new Bear class cutter. Rather than building the new ships it needs, the Coast Guard has had to rely on such programs as SLEP (Service Life Extension Program) and FRAM (Fleet Rehabilitation and Modernization) to update the vessels in the active fleet [Ref. 27: p. 24].

Because major overhauls and maintenance may be delayed certain areas are emphasized for repair through programs such as SLEP and FRAM. The proxy variables and weights which represent these areas are:

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<sup>1</sup>Conversation with OG-45 Manager, November 1982.



Materials (40 percent)

- PPI 101     Iron and Steel (30 percent)
- PPI 107     Fabricated Metal Products and Structures  
              (20 percent)
- PPI 114     General Purpose Machinery and Equipment  
              (20 percent)
- PPI 117     Electrical Machinery and Equipment (20  
              percent)
- PPI 1392    Insulation Materials (10 percent)

Labor (60 percent)

- AHE 373     Ship/Boat Building and Repair (40 percent)
- AHE 3731    Ship Building and Repair (50 percent)
- AHE 36      Electrical Equipment and Supplies (10 percent)

G.   OG-46   OCEAN ENGINEERING EQUIPMENT AND SUPPORT

Distributed from the Office of Ocean Engineering (G-EOE), Operating Guide 46 is responsible for aids to navigation, marine environmental protection (MEP) equipment, power sources and supplies for lighthouses and smaller aids to navigation. This account also procures such items as batteries, lamps, lanterns, flashers, fog detectors and sound signals for buoys, but the biggest single cost factor is the procurement of buoy bodies. Although some of the smaller buoys are plastic, most of them are made out of iron and steel. Table 3-1 gives the prices for buoys in fiscal years 1980, 1981, and 1982, and the estimated cost for fiscal year





TABLE 3-1  
BUOY PRICES (PER BUOY)

BUOY CLASS	<u>Price</u>			
	1980	1981	1982	1983
9 x 20	7,683	N/A	N/A	N/A
8 x 26 LR	10,311	12,252	13,000	13,000
8 x 26 LWR*	11,050	12,705	13,100	14,500
7 x 17 LR	6,737	9,387	10,300	10,100
6 x 20 LR	7,929	9,945	7,000	9,600
5 x 11 LR	4,990	5,244	8,900	8,700
3 1/2 x 8 LR	3,850	4,134	6,600	4,900
1CR	3,000	6,706	4,000	6,200
1NR	3,000	6,548	6,000	6,200
2CR	2,000	4,217	6,000	3,600
2NR	2,000	4,214	2,900	3,600
3CR	1,000	1,604	1,000	1,200
3NR	1,000	1,618	1,000	1,200

\* Does not include cost of whistle and whistle valve.



1983. Table 3-2 shows the annual percent increase in prices for the major buoy types. These two tables display the tremendous increase in prices for buoys of which the Coast Guard operates close to 50,000.

TABLE 3-2  
YEARLY PERCENT INCREASE IN BUOY PRICES

BUOY TYPE	1980-81	1981-82	1982-83	1980-83
8 x 26LR	18.8	6.1	0.0	26
8 x 26LWR	15.0	3.1	10.7	31
7 x 17LR	39.3	9.7	-1.9	50
6 x 20LR	25.4	-10.5	7.9	21
5 x 11LR	5.1	25.9	31.8	74
3 1/2 x 8LR	7.4	- 3.2	22.5	27

Because of the cost of buoys, the majority of funds spent on materials is for iron and steel. The remainder of the funds is spent on electronic components used on aids to navigation. The labor index is based on skilled and unskilled labor wages and represent the labor overhead rates at the Coast Guard Yard in Curtis Bay, Maryland where many of the buoys are produced and repaired.

Materials (40 percent)

PPI 101 Iron and Steel (80 percent)

PPI 1178 Electronic Components and Accessories  
(20 percent)



Labor (60 percent)

- AHE 17 Special Trade (skilled) (30 percent)
- AHE 15 General Building (unskilled) (60 percent)
- AHE 36 Electrical Equipment and Supplies (10 percent)

H. OG-54 SMALL ARMS AND AMMUNITION

Operating Guide 54 is under the direction of the Office of Military Readiness (G-OMR), and is responsible for the procurement of small arms, small arms ammunition, and pyrotechnics. The term small arms include the following:

- 40 mm
- 30 mm
- 25 mm
- 20 mm
- 12 GA
- .45 CAL
- .50 CAL
- 5.56 mm

Funds for larger weapons systems are provided by the Navy.

Since it has to be purchased annually, while the weapon itself needs only repairs, ammunition is the major cost area. The cost of small arms ammunition depends a great deal on the inventory on hand. The U.S. Army is responsible for supplying small arms ammunition within the Department of Defense. Stockpiles of ammunition from World War II and the Vietnam War are being depleted and the Army may have to



start purchasing from industry again. Being in the Department of Transportation, the Coast Guard may purchase either from the Army or commercial sources.

It is estimated by OMR that Coast Guard ordnance items have increased approximately 265 percent from their January 1979 prices. Presently most of the ammunition is used for annual training, which is vital for such missions as enforcement of law and treaties and drug interdiction. If prices continue to increase at the present rate, it is estimated that training may have to be reduced some 40 percent.

As the on-hand inventory is reduced, new production contracts will have to be established, which may mean retooling for production which may lead to higher prices.

As no suitable labor index could be found, industry indexes were selected as proxy variables, instead of breaking the weapons and ammunition into components which are used in their development.

PPI 151301 Small Arms (40 percent)

PPI 151302 Small Arms Ammunition (60 percent)

#### I. OG-56 PERSONNEL TRAINING

Operating Guide 56 is operated by the Office of Personnel in the branch of Training and Education (G-PTE). The funds allocated to this account are used to send Coast Guard members to various types of schools including Class A and C, flight, Postgraduate, and various types of field





training needed by Coast Guard units. OG-56 also pays for travel expenses of Coast Guard Auxiliarists in connection with any official training. Figure 3-1 shows the percent allocation of funds to various types of school, and Table 3-3 displays the funds spent in fiscal year 1982 in sending personnel to school.

TABLE 3-3  
FUNDS SPENT IN 1982

TYPE OF SCHOOL	DOLLARS SPENT	PERCENT
CLASS C	11,837,100	52
FIELD TRAINING	3,319,900	15
RECRUIT TRAINING	2,063,300	9
CLASS A	1,685,800	7
FLIGHT	1,373,400	6
MISCELLANEOUS	1,340,800	6
POSTGRADUATE	1,111,200	4.8
OFFICER CANDIDATE	40,900	.2

The category of miscellaneous covers such items as off-duty tuition, auxiliary training, and training programs for civilians working in the Coast Guard.

The higher cost items in OG-56 are per diem, travel and transportation, and tuition. To determine proxy variables, travel has been divided into five major modes; air, bus,



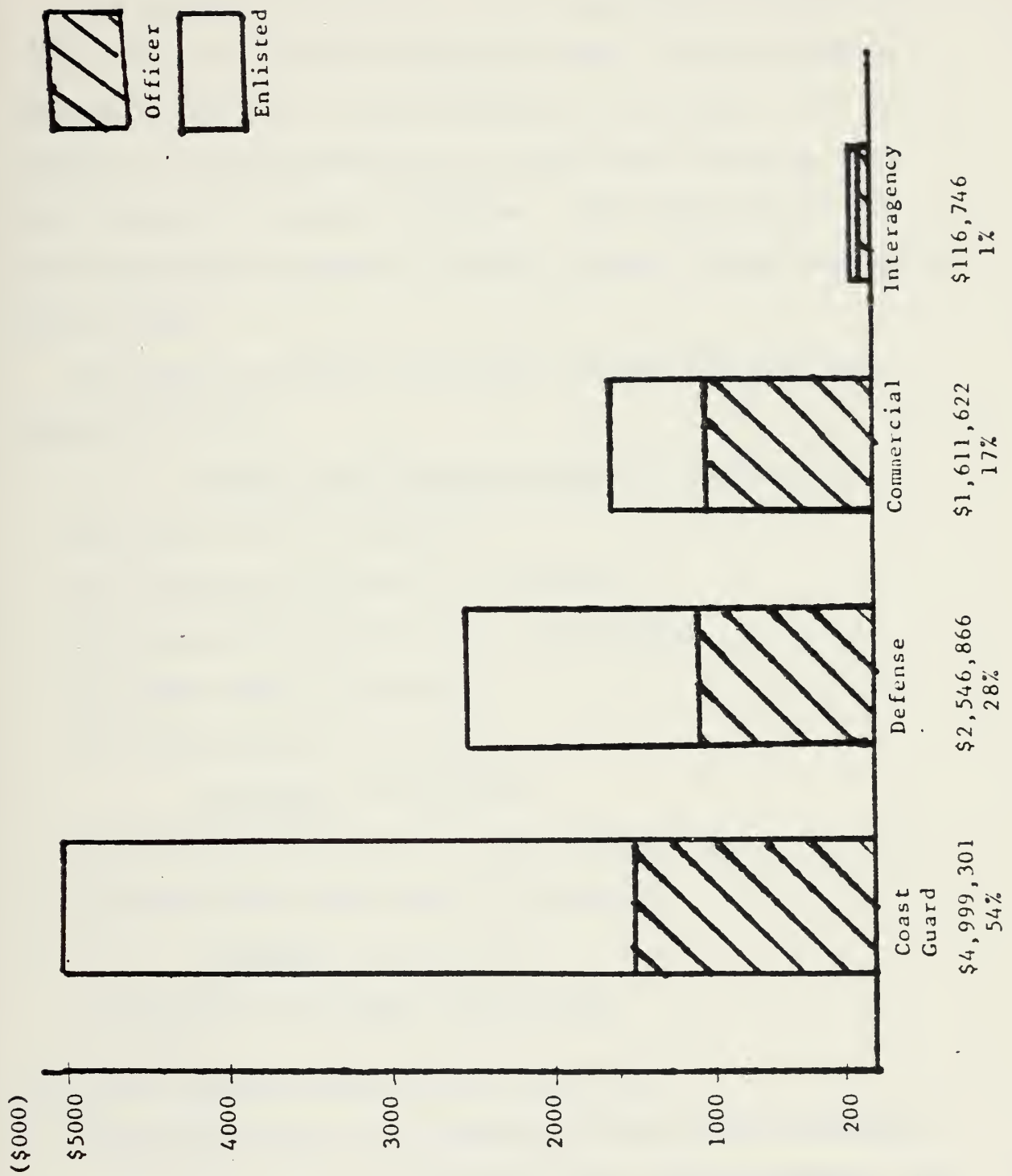


Figure 3-1. OG-56 School Type Report FY 82



mass transit, taxi, and train, and associated consumer Price Index codes chosen to represent them.

The per diem allowance given to personnel on official training orders is for lodging and food. This allowance differs according to the location of the school. The CPI indexes for lodging while out of town and food away from home are used as proxy variables. For tuition costs the proxy variable selected is the CPI index, tuition and other school fees.

The proxy variables and their assigned weights are summarized below.

Travel and Transportation (50 percent)

CPI Air Fare (60 percent)

CPI Intercity Bus Fare (10 percent)

CPI Intercity Mass Transit (10 percent)

CPI Taxi Fare (10 percent)

CPI Train Fare (10 percent)

Per Diem (30 percent)

CPI Lodging While Out of Town (60 percent)

CPI Food Away From Home (40 percent)

Tuition (20 percent)

CPI Tuition and Other School Fees

J. OG-57 MEDICAL SUPPLIES AND EQUIPMENT

Operating Guide 57 is operated by the Office of Health Services (G-K), and is responsible for the procurement and maintenance of major equipment which cost over 500 dollars.



The Coast Guard operates two large hospitals, one is at Kodiak, Alaska and the other is at the Coast Guard Academy in New London, Conn. Along with the two major hospitals, the Service has many smaller units with medical capabilities. The major equipment purchase at present is for mobile dental units at approximately \$100K.

The proxy variables used are a CPI index for non-prescription equipment and supplies, and a PPI index for electronic accessories and components, which represents advancements in technology in producing medical equipment [Ref. 28: p. 61]. For the labor index, the variables selected are average hourly earnings for medical instruments and supplies and for electrical equipment and supplies.

Material (50 percent)

CPI Medical Equipment and Supplies (90 percent)

PPI 1178 Electronic Accessories and Components (10 percent)

Labor (50 percent)

AHE 36 Electrical Equipment and Supplies (20 percent)

AHE 384 Medical Instruments and Supplies (80 percent)

K. FUEL -- A SPECIAL CASE

Although funds for fuel are distributed by Operating Guide 30, it was decided to look at it as an individual account because of its impact on the economy during recent years.





Fuel is divided into four different categories that a military service would encounter. Military aircraft primarily use AVGAS 100 and JP-4 jet fuel, with JP-4 being the major fuel used. As JP-4 fuel prices are highly correlated with kerosene prices [Ref. 29: p. 60], the proxy variable used is a PPI index for light distillates. Ships basically use petroleum bunker fuel number two, and therefore an index for middle distillates is used as a proxy variable [Ref. 30: p. 60]. An index for residual fuels represents the fuel used by stations and other land units, and the index for gasoline is used for fuel used by vehicles.

The selected proxy variables and weights are as follows:

PPI 0571	Gasoline (10 percent)
PPI 0572	Light Distillates (40 percent)
PPI 0573	Middle Distillates (40 percent)
PPI 0574	Residual Fuels (10 percent)

#### L. OG-01 HOUSING AND GENERAL MESS •

Operating Guide 01 is controlled by the Office of Personnel and is responsible for the costs of housing and general mess operation throughout the Coast Guard.

In developing the composite index for OG-01, the following variables and weights are used:

CPI Housing (70 percent)
CPI Food and Beverage (30 percent)



M. OG-20 TRAVEL AND TRANSPORTATION (PCS)

Operating Guide 20, which is also operated by the Office of Personnel, distributes funds to pay for the cost of personnel travel and shipments of household goods during a permanent change of station.

Travel of personnel is divided into travel modes and per diem. The travel modes considered are air, bus, train, and mass transit. Per diem is broken down into lodging and food. The transportation of household goods is split into four different types of carriers; truck, rail, postal service, and air.

The proxy variables used and their corresponding weights are listed below. The material section contains travel and transportation which have also been divided into different segments [Ref. 31: pp. 28-33].

Material (40 percent)

Travel (50 percent)

Travel Modes (50 percent)

CPI Air Fare (60 percent)

CPI Train Fare (20 percent)

CPI Bus Fare (10 percent)

CPI Mass Transit (10 percent)

Per Diem (50 percent)

CPI Lodging While Out of Town (70 percent)

CPI Food Away From Home (30 percent)



Transportation (50 percent)

Truck Freight (60 percent)

PPI 05 Fuels and Related Power Products (70 percent)

PPI 071201 Tires (10 percent)

PPI 141102 Motor Trucks (20 percent)

Rail Freight (20 percent)

PPI Railroad Freight (table) (100 percent)

Postal Service (10 percent)

PPI Postal Service (table) (100 percent)

Air Freight (10 percent)

PPI 05 Fuels and Related Power Products (100 percent)

Labor (60 percent)

Truck Freight (60 percent)

AHE 421 Trucking and Trucking Terminals (50 percent)

AHE 422 Public Terminals (50 percent)

Postal Services (20 percent)

AHE 73 Business Services (100 percent)

Air Freight

AHE 36 Electrical Equipment and Supplies (40 percent)

AHE 372 Aircraft Parts (60 percent)



#### IV. MODELS FOR DETERMINING COST OF LIVING RATES

##### A. METHODOLOGY

In forming a model to calculate the cost-of-living rates for each operating guide account, two major restrictions had to be fulfilled. The first restriction is that the model be simple and easy to use, and does not require knowledge of statistics or a great deal of mathematics on the part of the person operating it. The second restriction, that it use easy-to-obtain data, has been fulfilled by using indexes that are published monthly and can be obtained via a computer link with the Bureau of Labor statistics.

Two models will be introduced in this chapter, one that calculates the cost-of-living rate in the previous year, and then allocates the COLA funds based on that rate, and one that attempts to predict what the cost-of-living rate will be in the appropriate fiscal year.

To calculate an inflation rate, one must first determine the set of indexes for the years to be compared. The inflation rate experienced by that commodity or service is then  $[(BLS(t)) - (BLS(t-1))] \div BLS(t-1)$ . In this equation  $BLS(t)$  represents the Bureau of Labor Statistics index in year  $t$ , and  $BLS(t-1)$  is the value of that same index in the previous year. Both models use this formula but at different stages in the calculations.





Model (1) uses actual data to determine a cost-of-living rate for each operating guide. Because this model uses actual data, it is actually expressing the inflation rates in an early period to allocate funds in a later period. In this thesis, the lag between the periods is one year. An example is that of allocating the COLA funds for fiscal year 1983. Since fiscal year 1983 begins in October 1982, data from October 1981 and October 1982 were used to calculate the rates. In budgetary practice the appropriate months will depend on the period when the allocation must be made. Continuing with the example, the value of each proxy variable for the two time periods are listed and the general equation, given earlier in this section, is used to obtain the inflation rates. These rates are then used in each account's model to determine the twelve individual cost-of-living rates.

As model (2) involves regression, another method of developing the inflation rates was developed. Rates do not appear to be useful in a regression equation, as they represent a change between absolute values, and appear not to have a functional relationship among them. The indexes although representing absolute values, not relative values, are useful in regression. In model (2), one need only list the index values and insert them into the individual models. Due to the fact that the Average Hourly earnings are actual dollar figures and not an index, separate models for materials



and labor were developed in the accounts where appropriate. The indexes are then multiplied by their weights and summed together to produce a single material and labor index for each of the accounts. Then the general equation  $[(BLS(t) - BLS(t-1))] \div BLS(t-1)$ , is used between two appropriate time periods to obtain cost-of-living rates. In those cases with a material and a labor index, this equation must be used on each of these indexes to produce individual cost-of-living indexes for both labor and materials. To produce the final rate for an account, the labor and material indexes are multiplied by their assigned weights and added together. Step-by-step procedures for each model are given in Appendix A.

## B. RESULTS AND ANALYSIS

An initial question to be investigated is if the two procedures of calculating the individual cost-of-living rates produced similar results and can therefore be compared. Table 4-1 shows the results of the two methods during the same time period. The calculated cost-of-living index from 1969 to 1970 would be the appropriate calculations, using data from October 1969 and October 1970, to get the inflation rate between those two periods. The values in the table are the cost-of-living rates expressed as decimals. In taking the algebraic differences between the values, it appears that the methods are similar and produce the same results.



TABLE 4-1

## COMPARING METHODS OF DETERMINING INFLATION RATES

TIME PERIOD	ACCOUNTS (percent expressed as decimals)									
	(1) 30	(2)	(1) 41	(2)	(1) 42	(2)	(1) 43	(2)	(1) 45	(2)
1969-1970	.0575	.0574	.0604	.0615	.0544	.0550	.0665	.0633	.0390	.0438
1970-1971	-.0245	-.0231	.0378	.0410	-.0025	-.0038	.0799	.0815	.0430	.0384
1971-1972	.0526	.0545	.0504	.0508	.0415	.0416	.0617	.0626	.0466	.0467
1972-1973	.0581	.0582	.0651	.0663	.0446	.0447	.0851	.0867	.0590	.0599
1973-1974	.1040	.1126	.1837	.1867	.1307	.1332	.1324	.1200	.1904	.1926
1974-1975	.0792	.0799	.0766	.0749	.0701	.0714	.0525	.0515	.0877	.0866
1975-1976	.0639	.0666	.0746	.0755	.0609	.0611	.0795	.0791	.0758	.0763
1976-1977	.0690	.0555	.0716	.0706	.0710	.0718	.0692	.0691	.0584	.0619
1977-1978	.0862	.0833	.1053	.1070	.0791	.0801	.0862	.0875	.0894	.0901
1978-1979	.1006	.1042	.1036	.1039	.0919	.0929	.0933	.0922	.1007	.1004
1979-1980	.1114	.1098	.1100	.1087	.1107	.1086	.0559	.0531	.1229	.1218
1980-1981	.0995	.1024	.0899	.0897	.0871	.0897	.0462	.0465	.0934	.0887
1981-1982	.0592	.0590	.0618	.0640	.0578	.0580	.0324	.0321	.0594	.0582

TIME PERIOD	ACCOUNTS (percent expressed as decimals)							
	(1) 46	(2)	(1) 01	(2)	(1) FUEL	(2)	(1) 56	(2)
1969-1970	.0885	.0884	.0634	.0649	-.0150	-.0538	-	
1970-1971	.0758	.0761	-.0970	-.0968	.0153	.0184	-	
1971-1972	.0460	.0454	.0402	.0417	.0234	.0217	-	
1972-1973	.0613	.0612	.0702	.0650	.2744	.2748	-	
1973-1974	.2144	.2143	.1302	.1499	.9853	1.015	-	
1974-1975	.0552	.0550	.0873	.0871	.1119	.0891	-	



TABLE 4-1 (CONT.)

TIME PERIOD	ACCOUNTS (percent expressed as decimals)											
	(1)	46	(2)	(1)	01	(2)	(1)	FUEL	(2)	(1)	56	(2)
1975-1976	.0587		.0587	.0472		.0495	.0465		.0436		-	
1976-1977	.0581		.0578	.0530		.0623	.0814		.0759		-	
1977-1978	.0730		.0736	.0914		.0956	.1044		.1046		-	
1978-1979	.0852		.0861	.1233		.1232	.7111		.7149	.1300		.1338
1979-1980	.0720		.0723	.1286		.1288	.2722		.2675	.2186		.2217
1980-1981	.0758		.0761	.1010		.1018	.1894		.1912	.1525		.1554
1981-1982	.0375		.0370	.0500		.0505	-.0619		-.0615	.0920		.0900
	(1)	57	(2)	(1)	20	(2)						
1977-1978		-		.0760		.0768						
1978-1979	.0424		.0448	.1258		.1553						
1979-1980	.0782		.0833	.1444		.1437						
1980-1981	.1016		.1082	.1051		.1146						
1981-1982	.0871		.0876	.0608		.0562						





Of the 130 values, six (4.6 percent) were found to have differences above .0100, or one percentage point, and 15 had differences above .0050, or one half of a percentage point. For the entire 130 values, the mean (of the differences) was .0028, or .28 of a percent, with a standard deviation of one half of a percentage point, .0050. A possible cause for the differences is round-off error as in model (1) the rates were inserted into the individual models expressed to the ninth decimal place, whereas in model (2), the indexes were used in the individual models rounded to the nearest one hundredth. Therefore it appears that the final result does not depend on the stage at which percent rates are determined. Although model (2) must use indexes throughout all its calculations to be useful in predicting, the ability to use percent values at the beginning of model (1) saves many steps of calculations, which is important if a computer is not present. Values are not available for accounts 56, 57, and 20 until 1977 and 1978 as indexes that are used in their individual models were not published by BLS until this time period.

In the field of economics, the use of previous values to predict present, or future values is quite common. An example of this is the Cobweb Theorem [Ref. 32: p. 24], which assumes that supply reacts to price with a lag of one period,

$$s(t) = a(1) + b(1)p(t-1)$$



where a and b are constants and p represents price. Another situation would be,

$$s(t) = a(1) + b(1)p(t \text{ hat})$$

where  $p(t \text{ hat})$  is the expected price, or the price that produces, at the moment of starting producing, one thinks will hold [Ref. 33: p. 28]. A method of calculating the expected value of the price, would be to relate the expected price to all previous prices.

$$\begin{aligned} p(\text{hat}) &= \beta p(t-1) + \beta(1-\beta)p(t-2) + \beta(1-\beta)^2 p(t-3) \\ &+ \dots + \beta(1-\beta)^{n-1} p(t-n) + \dots \end{aligned}$$

In this equation  $\beta$  is a positive coefficient not greater than one, and the expected price is a weighted average, with geometrically declining weights, of all past observed prices [Ref. 34: pp. 30-31]. As most economic data is a time series, a collection of observations made sequentially in time [Ref. 35: p. 1], time series models with distributed lags are commonly used. This includes moving averages, autoregressive models, mixed models, and differencing techniques. These models attempt to take out variations such as trends, seasonal effects, and other cycles, so that the data observations are independent of each other. These models can become quite



complex and usually require a computer with library programs for computation.

As a restriction was that any model proposed should be easy to compute, the model introduced in this chapter consists of finding a functional form between past values, and then performing regression on the values to form a least-squares equation in which to predict the index value for the upcoming fiscal year. A key decision was how much past data to use to accurately predict a value and at the same time have present values influence the prediction more than the past data does. In an autogressive time series process this is performed by an equation such as [Ref. 36: p. 231]:

$$n_t = (1-\theta)(n(t-1) + \theta(n(t-1) + \theta^2 n(t-2) + \dots) + a_t$$

where past information is exponentially discounted. But for the proposed simple model, values representing a certain time period was decided on. A lag of five years was selected as it appeared to give suitable predictions and still leave a suitable number of degrees of freedom. By looking at scatter plots of the data, a straight linear model  $Y = a + bX$  was attempted with Y being the past five year's index values, and X being the number of years (1 to 5). Through the use of model (2), the latest indexes were calculated and the regression updated by including these new values and dropping those from five years ago. Statistical results, for F-tests,



t-tests, Durbin-Watson, Coefficient of Determination, and standard error of prediction are listed in Appendix B, along with concepts of regression. The scatter plots were also investigated at different scales, and a slight curvature was discovered. Different transformations were attempted and the equation

$$\ln (Y) = \ln (a) + bX$$

was found to be the best at linearizing the data. Table 4-2 shows the predicted values obtain by each of the regression models, as compared to the actual value obtained for the time period being predicted. Accounts 43 and 01 maintained a linear model and the account fuel maintained a log model throughout. From the table, one can see that the log model produced "better" predictions than the linear model as compared with the actual values obtained, except for in fiscal year 1982. The log model produced higher values than the linear model throughout all time periods, and values of both models were rising when the actual rates actually declined between fiscal years 1981 and 1982. Therefore the linear model appears to be the better predictor for 1982, but this is only because they were below the actual results from the beginning and caught up with the actual values only because the actual values decreased. Therefore for the period 1981-82, it is inconclusive which model is the better predictor.





TABLE 4-2

## PREDICTIONS FOR FY 1979

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 78-79
30	.0507	.0578	.1006
41	.0494	.0520	.1036
42	.0496	.0509	.0929
*43	.0485	.0485	.0922
45	.0556	.0623	.1004
46	.0423	.0496	.0861
54	.0526	.0682	.0974
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0451	.0451	.1232
*Fuel	.0442	.0442	.7149

	PREDICTIONS FOR FY 1980		ACTUAL 79-80
30	.0438	.0527	.1098
41	.0560	.0620	.1087
42	.0522	.0531	.1086
*43	.0550	.0550	.0531
45	.0508	.0561	.1218
46	.0442	.0554	.0723
54	.0500	.0661	.1079
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0400	.0400	.1288
*Fuel	.0895	.0895	.2675



TABLE 4-2 (CONT.)

## PREDICTIONS FOR FY 1981

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 80-81
30	.0527	.0676	.1024
41	.0645	.0732	.0897
42	.0544	.0605	.0897
*43	.0687	.0687	.0465
45	.0535	.0615	.0887
46	.0547	.0650	.0761
54	.0578	.0795	.1102
56	N/A	N/A	N/A
57	N/A	N/A	N/A
20	N/A	N/A	N/A
*01	.0576	.0576	.1018
*Fuel	.2133	.2133	.1912

	PREDICTIONS FOR FY 1982		ACTUAL 81-82
30	.0692	.0878	.0592
41	.0783	.0874	.0640
42	.0682	.0769	.0580
*43	.0707	.0707	.0321
45	.0756	.0855	.0582
46	.0598	.0713	.0370
54	.9652	.0920	.0595
56	.1203	.1883	.0900
57	.0512	.0773	.0876
20	.0810	.1132	.0562
*01	.0817	.0817	.0505
*Fuel	.4090	.4090	-.0614



TABLE 4-2 (CONT.)

## PREDICTIONS FOR FY 1983

ACCOUNT	LINEAR PREDICTION	LOG PREDICTION	ACTUAL 82-83
30	.0863	.1025	N/A
41	.0829	.0915	N/A
42	.0816	.0899	N/A
*43	.0601	.0601	N/A
45	.0876	.0953	N/A
46	.0703	.0776	N/A
54	.0852	.1085	N/A
56	.1338	.1905	N/A
57	.0547	.0626	N/A
20	.1063	.1485	N/A
*01	.1000	.1000	N/A
*Fuel	.4910	.4910	N/A

\* OG-43 Linear Model only  
 OG-01 Linear Model only  
 Fuel Log Model only  
 N/A: Data not available



Because of the above result it appears that even at lag five, both models contain a trend that is based on a relationship between the indexes of past years. This trend would account for both models producing increasingly higher rates, even though the actual rates were growing smaller. This trend may possibly extend into 1983 and 1984, before the decrease in 1982 influences the results. This can only be determined by observing the values over many years. As stated earlier, this trend can be eliminated by the use of time series techniques, but this also increases the complexity of the models.

In summary, three models for calculating the cost-of-living rate for the operating guides have been introduced. One uses actual data, but allocates funds for one period based on inflation rates for a previous period. The other two models use simple regression techniques in an attempt to predict the values of the different indexes for the upcoming years. But because of trends and cycles, these estimates may be poor. The next chapter introduces a model that uses the computed individual inflation rates to allocate the COLA funds to the Operating Guides.





## V. MODEL FOR ALLOCATION OF FUNDS

The model developed to allocate the COLA funds to the operating guides is based on a simple formula as follows:

$$\begin{array}{l} \text{Allocation (i)} \\ \text{(in dollars)} \end{array} = \left( \frac{B(i) \cdot COL(i)}{\sum B(i) \cdot COL(i)} \right) \cdot [(\sum B(i)) \cdot COLA]$$

where:

$B(i)$  = base of OG account  $i$  (dollars)

$COL(i)$  = calculated cost-of-living rate for OG account  $i$  expressed in decimal form

$\sum B(i) \cdot COL(i)$  = summing up over all accounts the two terms above multiplied together (dollars)

$COLA$  = this is the COLA rate as given by OMB, expressed as a percent.

The first term represents the amount of money actually needed by the account to counter the effects of inflation weighted by the total amount of COLA actually needed by the appropriation category Operating Expenses. This term also represents the cost-of-living for each account in relation to the cost-of-living of other accounts weighted by the budgets of each. The second term is the total COLA received from OMB, which is just last year's total non-pay Operating Expenses multiplied by the COLA rate provided by OMB. When these two terms are multiplied together, the allocation, for each account, is provided in dollars.



The input data required are the twelve cost-of-living rates computed in Chapter IV, the cost base for each account from the previous fiscal year, and the COLA rate as provided by OMB. Results were simulated for fiscal years 1979 through 1983 for model (1).

Due to a lack of data, the actual base for each operating guide could not be obtained for each year, except for fiscal year 1983. This was deemed acceptable as the main concern was if the model allocated in an equitable manner and not if the specific amount allocated was correct. The actual total base for non-pay operating expenses for each year was obtained and so was the COLA rate for each year. To keep the data as close as possible to actual amounts, the percent that each account represented of the total Operating Expense base in 1983, was used in the other years. Since fuel is paid by OG-30, data for fuel was calculated as 10 percent of OG-30's budget. Table 5-1 shows the data used as the base for allocating the COLA funds. The COLA rates used, as provided by OMB, are 6 percent in 1979, 7.6 percent in 1980, 9.45 percent in 1981, 7.8 percent in 1982, and 8 percent in 1983. Table 5-2 gives the simulated results from using model (1). The column, Cost of Living, is the rate calculated for each model from the proxy variables and assigned weights. Actual Funds correspond to this cost-of-living rate multiplied by each account's base. This computed figure represents the amount of money each account



TABLE 5-1  
BASE AMOUNTS (\$000)

Percent of Total	ACCOUNT	Base used for allocation in				
		1979	1980	1981	1982	1983
57.0	30	196,823	214,919	228,085	310,649	356,774
7.5	41	28,775	31,421	33,346	45,390	52,160
9.2	42	35,298	38,543	40,904	55,697	63,983
6.4	43	24,555	26,812	28,455	38,733	44,510
8.1	45	31,077	33,935	36,013	49,021	56,332
1.6	46	6,139	6,703	7,114	9,683	11,127
.5	54	1,918	2,095	2,223	3,026	3,477
2.4	56	9,208	10,055	10,671	14,525	16,691
1.4	57	5,371	5,865	6,225	8,473	9,737
4.0	20	15,347	16,758	17,784	24,208	27,819
0.0	01	3,453	3,771	4,001	5,448	6,259
10 of OG-30	Fuel	25,706	28,069	29,789	40,549	46,596
	COLA Amount	23,020	31,840	42,016	47,206	55,637
	TOTAL OE	383,670	418,946	444,610	605,204	695,465



TABLE 5-2  
ALLOCATION OF COLAR FUNDS

FISCAL YEAR 1979

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.086185	16963186.02	11766043.31	69.3622
41	.105279	3029404.04	2101262.06	69.3622
42	.079055	2790483.79	1935541.65	69.3622
43	.086227	2117303.98	1468609.16	69.3622
45	.089404	2778407.70	1927165.41	69.3622
46	.072952	447852.16	310640.22	69.3622
54	.083032	159255.40	110463.09	69.3622
56	.056620	521356.98	361624.80	69.3622
57	.040159	215693.98	149610.14	69.3622
20	.075993	1166264.59	808947.08	69.3622
01	.091390	315569.73	218886.18	69.3622
Fuel	.104396	2683603.21	1861406.90	69.3622
Total		33188368.00	23020200.00	69.3622

FISCAL YEAR 1980

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.100642	21629883.47	11630807.51	53.7719
41	.103572	3254336.16	1749919.62	53.7719
42	.091942	3543720.98	1905527.45	53.7719
43	.093335	2502497.29	1345641.29	53.7719
45	.100719	3417898.42	1837870.22	53.7719
46	.085178	570948.25	307009.94	53.7719
54	.097452	204161.91	109781.81	53.7719
56	.129961	1306757.99	702669.10	53.7719
57	.042417	248775.71	133771.52	53.7719
20	.125783	2107871.95	1133443.60	53.7719
01	.123289	464922.78	249997.99	53.7719
Fuel	.711143	19961073.34	10733455.96	53.7719
Total		59212848.00	31839896.00	53.7719





TABLE 5-2 (CONT.)

## FISCAL YEAR 1981

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.111425	25414367.14	19638943.53	77.275
41	.109991	3667760.35	2834260.56	77.275
42	.110652	4526110.62	3497550.43	77.275
43	.055878	1590008.45	1228678.48	77.275
45	.122853	4424304.41	3418879.72	77.275
46	.072020	512350.24	395918.47	77.275
54	.101463	225552.29	174295.46	77.275
56	.218576	2332424.65	1802380.35	77.275
57	.078167	486589.71	376012.03	77.275
20	.144392	2567867.57	1984318.79	77.275
01	.128605	514548.64	397617.28	77.275
Fuel	.272239	8109728.45	6266789.89	77.275
Total		54371600.00	42015645.00	77.275

## FISCAL YEAR 1982

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.099481	30885762.43	23865165.87	77.2692
41	.089921	4081514.08	3153751.21	77.2692
42	.087081	4848583.84	3746459.48	77.2692
43	.046153	1787644.21	1381297.47	77.2692
45	.093438	4589425.63	3539255.92	77.2692
46	.075841	734368.59	567440.29	77.2692
54	.110085	333117.24	257396.86	77.2692
56	.152473	2214669.93	1711256.61	77.2692
57	.100588	852282.32	658551.30	77.2692
20	.105089	2543994.73	1965723.08	77.2692
01	.101037	550449.71	425327.81	77.2692
Fuel	.189401	7680019.97	5934286.09	77.2692
Total		61092832.00	47205912.00	77.2692



TABLE 5-2 (CONT.)

FISCAL YEAR 1983

ACCOUNT	COST OF LIVING	ACTUAL FUNDS	COLA AMOUNTS	PERCENT OF ACTUAL
30	.059228	21131010.22	31030907.93	146.8501
41	.061767	3221766.76	4731167.44	146.8501
42	.057807	3698665.18	5431493.22	146.8501
43	.032429	1443414.72	2119655.85	146.8501
45	.059441	3348430.42	4917173.16	146.8501
46	.037484	417084.48	612488.95	146.8501
54	.061768	214767.33	415386.03	146.8501
56	.092006	1545672.61	2255136.64	146.8501
57	.089706	873467.36	1282687.62	146.8501
20	.060746	1689892.95	2481609.35	146.8501
01	.049992	312899.92	459493.82	146.8501
Fuel	-.061875	-2883127.53	0.0	0.0
Total		35003936.00	55637200.00	158.9456



would receive if COLA funds were unlimited, and represents the amount they actually require. COLA amounts are the amount allocated to each account based on a given fixed total COLA amount. The final column is the percent of the funds actually required that the COLA amount received represents. As seen in Table 5-2, the model allocates the same percent of the funds actually needed to each account. In this way no account is made "better off" than another account. Neither this model, nor this thesis, attempts to prioritize the accounts to decide if any should receive any more funds. Also note that in fiscal year 1983 fuel had a negative cost-of-living and therefore did not require any further funds. Because of this and the fact that the COLA rate for 1983 (8.0 percent) was greater than the inflation rate in 1982 (6.1 percent for CPI, 6.0 percent for GNP deflator), the other accounts received over 100 percent of the funds they actually acquire.

Table 5-3 lists the allocation of COLA based on the method presently used, that of multiplying each account's base by the COLA rate. From the table it can be observed that in using this method, each account does not receive an equal percent amount of their cost-of-living. In Table 5-3, the column Percent of Proposed is the percentage that the allocation under the present method is of the allocation of the proposed model. The column Percent of Actual is defined the same as before, except now the present method's



TABLE 5-3

## ALLOCATION OF COLA FUNDS--PRESENT METHOD

FISCAL YEAR 1979 (COLA Rate 6 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	11809380.00	100.4	69.6
41	1726500.00	82.2	57.0
42	2117880.00	109.4	75.9
43	1473300.00	100.3	69.6
45	1864620.00	96.7	67.1
46	368340.00	118.6	82.2
54	115080.00	104.2	72.3
56	552480.00	152.8	106.0
57	322260.00	215.4	149.4
20	920820.00	113.8	79.0
01	207180.00	94.7	65.7
Fuel	1542360.00	82.9	57.5

FISCAL YEAR 1980 (COLA Rate 7.6 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	16333844.00	140.4	75.5
41	2387996.00	136.5	73.4
42	2929268.00	153.7	82.7
43	2037712.00	151.4	81.4
45	2579060.00	140.3	75.5
46	509428.00	165.9	89.2
54	159220.00	145.0	78.0
56	764180.00	108.8	58.5
57	445740.00	333.2	179.]
20	1273608.00	112.4	60.4
01	286596.00	114.6	61.6
Fuel	2133244.00	19.9	10.7





TABLE 5-3 (CONT.)

## FISCAL YEAR 1981 (COLA Rate 9.45 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	21554032.50	109.7	84.8
41	3151197.00	111.2	85.9
42	3865428.00	110.5	85.4
43	2688997.50	218.9	169.1
45	3403228.50	99.5	76.9
46	672273.00	169.8	131.2
54	210073.50	120.5	93.1
56	1008409.50	55.9	43.2
57	588262.50	156.4	120.9
20	1680588.00	84.7	65.4
01	378094.50	95.1	73.5
Fuel	2815060.50	44.9	34.7

## FISCAL YEAR 1982 (COLA Rate 7.8 Percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	24216582.00	101.5	78.4
41	3540420.00	112.3	86.7
42	4342962.00	115.2	89.6
43	3021174.00	218.7	169.0
45	3823638.00	108.0	83.5
46	755274.00	133.1	102.8
54	236028.00	91.7	70.9
56	1132950.00	66.2	51.2
57	660894.00	100.4	77.5
20	1888224.00	96.1	74.2
01	424944.00	99.9	77.2
Fuel	3162822.00	53.3	41.2



TABLE 5-3 (CONT.)

FISCAL YEAR 1983 (COLA Rate 8 percent)

ACCOUNT	COLA AMOUNT	PERCENT OF PROPOSED	PERCENT OF ACTUAL
30	28541920.00	92.0	135.1
41	4172800.00	88.2	129.5
42	5118640.00	94.2	138.4
43	3560800.00	168.0	246.7
45	4506560.00	81.6	134.6
46	890160.00	145.3	213.4
54	278160.00	88.2	129.5
56	1335280.00	59.2	87.0
57	778960.00	60.7	89.2
20	2225520.00	89.7	131.7
01	500720.00	109.0	160.0
Fuel	3727680.00	(No Funds Allocated)	329.3



allocation is used instead of the model's allocation. The accounts that suffer are those that encounter the highest inflation rates. In fiscal year 1979, accounts 41 and Fuel were above 10 percent and 45 and 01 near nine percent. While the other totals exceeded the proposed amounts, these four accounts did not. Accounts 56 and 57 had low inflation rates, 5.6 percent and 4 percent respectively, but were also the big gainers under the present method.

In fiscal year 1980, Fuel had a 71 percent inflation rate which caused a low percentage of the actual needs for all accounts under the proposed model. But under the present method all the accounts except Fuel were better off than under the proposed model. It must be noted the Fuel was allocated only 10.7 percent of its needs, whereas OG-57 was over-allocated as it received more than it actually needed. Also in fiscal year 1983, Fuel had a negative inflation rate and under the proposed model received zero adjustment funds. But under the present system Fuel received more than three million dollars even though there was no need for any inflation augmentation.

In summary, this model appears to have three features that will benefit the Coast Guard's budget process. One, it allocates an equal percentage share to each operating guide based on inflation rates developed for each account. Two, the model does not overallocate funds to any of the accounts as the present method does. And finally, the proposed model allocates zero funds to those accounts experiencing a negative or zero inflation rate.



## VI. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to determine if a method could be developed that would allocate COLA funds based on inflation rates for the individual Operating Guides. Chapters IV and V show the development of models to estimate each account's inflation rate and then allocate the COLA funds based on these rates.

In developing the models, a major step is the formulation of market baskets and the assigning of weights. If these are incorrect, the models will not accurately estimate the inflation rates and thereby cause a misallocation of COLA funds. As this is an initial step for the Coast Guard in developing market baskets for the Operating Guide accounts, it is recommended that each account manager review the proposed market baskets and weights developed in this thesis. Further research could be conducted to make the market baskets more detailed, which would enhance even more the probability of the estimated inflation rates being correct. This may include a different market basket for each of the various cutters, aircraft, and stations.

Since the Coast Guard uses COLA funds to cover price increases which have incurred in the previous year [Ref. 37], model (1), which uses data from the previous year to allocate funds in the upcoming year, appears to be acceptable.





Chapter IV points out the fact that although any prediction estimate will contain some error, when dealing with price indexes time series analysis is necessary. Table 4-2 shows the possible errors in predicting when using a simple predictive model. As an accurate allocation of funds is necessary, a prediction model is not recommended until further research is done into the models proposed in time series analysis.

The allocation model proposed in Chapter V, appears to meet all requirements and has at least three features, as outlined in Chapter V, that will benefit the Coast Guard's budget process. Upon review of the market baskets and assigned weights, and selection of a model to compute the individual account inflation rates, this model is recommended for use in allocating a fixed total of money.

The proposed allocation model also shows the difference between the COLA amount received from OMB and the amount of funds actually needed to counter the effects of inflation. The percentages given in Table 5-2 imply that the COLA funds received have been insufficient during a majority of the years. The results during fiscal year 1983 are caused somewhat by a low inflation rate, but the percentage figures have also been inflated because the funds were allocated among eleven accounts and not twelve.



## APPENDIX A

Step-by-step procedures for using Model (1), which uses data from a past period to allocate COLA funds in a later period.

(1). List the individual 61 Bureau of Labor Statistics indexes which are used as proxy variables.

(2). List the value for each index as listed in the appropriate publication. Do this for the months as necessary to get an annual rate.

(3). Using the formula  $[(BLS(t) - BLS(t-1)) \div BLS(t-1)]$  compute the percent change in indexes, but in decimal form.

Figure B-1 gives an example of the above procedure. The example shown in this figure is the allocation of COLA funds for fiscal year 1982. The indexes are listed as they would be read into the computer. Since fiscal year 1982 begins 1 October 1981, index values are found for October 1980 and October 1981. Note that the COLA rate, as given by OMB for fiscal year 1982, is listed in percent form.

(4). List the dollar base that each account will use for the allocation of funds. As explained in the text, these base figures are the amount of money budgeted to each account the previous fiscal year.

(5). List the total non-pay Operating Expenses base, summation of totals listed in step 4 above.



(6). List the total COLA amount in dollars. This amount equals the total amount from step 5, multiplied by the COLA rate as listed on Figure B-1 divided by 100.0.

Figure B-2 demonstrates the appropriate listings done in parts 4, 5, and 6.

(7). If computations are done by computer, one must read in the index changes (as decimals), the COLA rate (as a percent), the base figures for each account, the total non-pay Operating Expenses (OE) base, and the COLA amount in dollars. These values shall be read into the computer in accordance with the format statements given in Program number one, which is Figure B-4.

(8). If done by calculator, the following steps are to be taken:

(a) Figure B-4 gives the individual equations to calculate each account's inflation rate. Insert the appropriate  $Z(I)$  index change value and multiply by the corresponding weights as given in the program. As an example, for OG-30, use the model that calculates FP. Insert the index change values for  $Z(5)$  (.111996811),  $Z(31)$  (.099715099),  $Z(47)$  (.080291971),  $Z(48)$  (.093573844), and  $Z(49)$  (.095726496). Then perform the appropriate mathematical functions.

(b) Multiply each account's rate, as computed above in decimal form, by its base figure.

(c) Sum the terms calculated in (b).

(d) Determine the individual COLA allocations by using the following equation:



$$OG(i) = (\text{Value}(i) \text{ from (b)} \div \text{value from (c)}) \times \text{value from (d)}$$

where  $i$  = an individual account,  $i = 1, 12$ .  $OG(i)$  gives the allocation for the account ( $i$ ).

Step-by-step procedures for using Model (2), which uses regression techniques to predict index values to use in allocating COLA funds.

(1). List the indexes and values as in Figure B-1, but only the latest values. Using the example for fiscal year 1982, list the index values for only 1981. Do not perform any percentage calculations at this stage.

(2). Using computer program number two (2), Figure B-5, calculate the aggregate indexes for each account. Where appropriate both a material and a labor index will be calculated.

(a) To use the computer, read in the index values for the single year.

(b) The output will be the aggregate indexes.

(c) If using a calculator, use the index values as listed on Figure B-1 and insert them in the appropriate locations as outlined in Figure B-5.

(d) The final output will be indexes and dollar figures (for labor values), to two decimal places.

(3). List the values obtained above in Figure B-3 under actual. Update the appropriate regression program being





used. Ensure that the values for the program represent the correct 'lag' you desire to have. With a lag of five to predict 1982 values, actual values from 1977, 78, 79, 80, and 81 would be required.

(4). List the predicted values in Figure B-3 under predicted. Then use the equation  $[(BLS(t) - BLS(t-1)) \div BLS(t-1)]$  to compute the index change percent.

(5). Multiply each percent, expressed in decimal form, by its appropriate weighting listed below.

<u>ACCOUNT</u>	<u>LABOR</u>	<u>MATERIAL</u>
30	.5	.5
41	.58	.42
42	.6	.4
43	.56	.44
45	.6	.4
46	.6	.4
54	None	1.0
56	None	1.0
57	.5	.5
20	.6	.4
01	0	1
Fuel	0	1

(6). If an account has separate indexes for labor and material add these together, after performing the operations in Part 5, to obtain the final index. Using OG-30 as an example, the following calculations would be made:



OG-30 Material .0776 (from B-3)  $\times .5 = .0388$

OG-30 Labor .0605  $\times .5 = .0303$

Final OG-30 Index =  $.0388 + .0303 = .0691$

(7). Insert these values into the indicated location in Program number three (3), which is Figure B-6. Figure B-7 gives a list of variables used in the computer programs and their definitions. This figure indicates which accounts, FP through Fuel represent.

(8). If using a calculator, use the same procedure as outlined in steps 8(b) through 8(d) of the first section.

Figure B-8 shows the final output received from using computer programs one and three.



## APPENDIX B

The use of simple linear regression in this thesis is based on postulating a functional relationship between an independent variable and a dependent variable, and then predicting values based on this relationship. The method used to determine if a simple relationship does exist is a graphical method called a dot or scatter diagram. This graph suggests a relationship when graphing the independent variable on the X-axis and the dependent variable on the Y-axis. Since we are interested in using linear regression, we desire a linear relationship. If a linear relationship does not exist, various transformations such as log, square root, inverse, and the squared value of the independent, dependent or both, variables may be used in an attempt to achieve a linear relationship. In the thesis a linear model was attempted, and also a log transformation on the dependent value was developed. The log model was attempted because a slight curvature was observed in some of the curves. The general models used are  $Y(j) = a + bX(j) + e(j)$  and  $\ln(Y(j)) = \ln(a) + bX(j) + e(j)$  where the  $e(j)$ 's represent the variations from the true value of Y and are termed the statistical error.

Tables B-1 and B-2 give the results of various statistical tests used in regression. These tests are explained in the following paragraphs.



The Coefficient of Determination,  $R^2$ , is a measure that is commonly used to describe how well the regression line fits the data. The value obtained is the proportion of variability explained by the regression on the X values. The larger the  $R^2$  value, the more variability explained, and the better the regression line fits. The majority of  $R^2$  values are above .90 which means that at least 90 percent of the variability in Y is explained by the regression on X. The lowest value obtained is 74 percent obtained for the material of OG-43 in Table B-1. The level of  $R^2$  deemed satisfactory depends upon the desires of the user.

The F-test involves an Analysis of Variance with sum of square errors for the regression and residual values. The F-test measures whether or not, adding the term  $bX$  to the model, is a significant improvement over the very simple model  $Y = a$ , or just the intercept. This is equivalent to saying that the additional parameter is different than zero, and therefore Y is related to X. The null hypothesis for this test is  $Y(j) = a + e(j)$  or  $b = 0$ , and the alternative hypothesis is  $Y(j) = a + bX(j) + e(j)$  or  $b \neq 0$ . If the calculated F-value given in Tables B-1 and B-2 is larger than the F-value given in a statistical table, then reject the null hypothesis, implying that  $b \neq 0$ . Degrees of freedom (1,3).

<u>alpha level</u>	<u>Table F-value</u>
0.05	10.13
0.01	34.12





Of the 78 values given in Tables B-1 and B-2, only eight did not reject at the .01 level and only one value was not significant at .05 alpha level. This was again the material model for OG-43, which had a F-value of 8.63.

The t-test values measures the importance of the coefficients calculated in the regression model. If the calculated t-value given in Tables B-1 and B-2 is greater than the statistical tabled t-value, for the desired alpha level, then the coefficient is important and different than zero. For the t-test the degrees of freedom equal four.

<u>alpha level</u>	<u>table t-value</u>
0.05	2.78
0.01	4.60
0.001	8.61

All t-values are significant at the .05 level, only three are not significant at .01 and at the .001 level, twenty values fail to reject the null hypothesis.

An important assumption that is made in linear regression is that expected value of the error terms equals zero. If this is not true, then it is possible that the disturbance occurring at one point in time may be correlated with any other disturbance. It can be shown that if the error terms are correlated, then the estimates of the statistics just described will not be accurate and will usually be overestimated.

A test for the presence of autoregression is the Durbin-Watson test. Unfortunately, most books contain tables for



the test beginning at  $n = 15$ , and the regression equations used contained only five observations. Therefore no formal test could be used, but there is a rule-of-thumb that when the statistic is near 2.0, the user can be confident that the errors are not correlated [Ref. 38: p. 13]. Using this rule, the Durbin-Watson values contained in Tables B-1 and B-2 appear to be satisfactory, except for the cases where the value is above 3.00. In these situations the user must be aware that the F-values and the t-values may be overestimated. Although the error terms appear to be uncorrelated, there may be high correlation among the X values themselves. As explained in the text, this is where time series analysis would be utilized.

Predictions are obtained by substituting values for the independent variables,  $X = 6$  in this case, into an estimated regression equation. Two important terms in prediction are interpolation and extrapolation. Interpolation is when the predictor is within the range of the data, and extrapolation occurs in cases when the predictor is outside the range of the data. Interpolations tend to be accurate and reliable, while extrapolations are less accurate and possibly unreliable. Extrapolation is used in this thesis.

The standard error of prediction is made up of a variance due to estimating and the variance of the regression equation. The smaller the standard error of prediction the better, but the level of error that is satisfactory is



based on the user's desires. Errors of prediction are given in Tables B-3 and B-4 for predicated values for fiscal years 1981, 1982, and 1983.

More detailed information about simple linear regression can be obtained from the books Applied Linear Regression [Ref. 39], and Statistical Methods in Research and Production [Ref. 40], or any other book on regression.

In the event that Model (2) is used, actual values for the regression equations are given in Table B-5. These values are for use in the linear model. For the log model, take the natural log ( $\ln$ ) of the appropriate values for which the log model is used.



TABLE B-1  
REGRESSION RESULTS FOR LINEAR MODEL  
N = 5

PREDICTING FOR 1981						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 144.2 + 20.0X	76.70	.962	7.236	25.25, 8.9	1.385
30 LABOR	Y = 4.56 + .433X	177.6	.983	.1027	42.3, 13.3	1.637
41 MAT.	Y = 169.7 + 20.2X	154.2	.981	2.944	59.24, 24.1	1.968
41 LABOR	Y = 5.05 + .717X	165.0	.982	.176	27.2, 12.8	2.12
42 MAT.	Y = 127.9 + 13.3X	75.2	.961	4.84	25.19, 8.7	1.446
42 LABOR	Y = 4.43 + .532X	373.1	.992	.087	48.5, 19.3	1.45
43 MAT.	Y = 182.5 + 23.2X	126.3	.977	6.52	26.7, 11.2	2.503
43 LABOR	Y = 7.27 + .55X	248.4	.988	.109	63.3, 15.8	1.459
45 MAT.	Y = 172.3 + 19.7X	230.18	.987	4.103	40.04, 15.2	1.415
45 LABOR	Y = 5.12 + .67X	79.1	.963	.238	20.55, 8.9	1.52
46 MAT.	Y = 191.1 + 23.8X	347.3	.991	4.042	45.1, 18.6	2.179
46 LABOR	Y = 7.24 + .505X	204.1	.986	.112	61.8, 14.3	1.39
54 MAT.	Y = 140.1 + 16.6X	209.3	.986	3.63	36.8, 14.5	1.42
56 MAT.	NONE					
57 MAT.	NONE					
57 LABOR	NONE					
20 MAT	NONE					
20 LABOR	NONE					
01 MAT	Y = 152.2 + 21.6X	92.6	.969	7.10	20.4, 9.6	1.414





TABLE B-1 (CONT.)

PREDICTING FOR 1982						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	$Y = 151.3 + 24.9X$	243.5	.987	5.046	79.4, 22.4	1.623
30 LABOR	$Y = 4.8 + .521X$	525.8	.994	.072	63.1, 23	1.420
41 MAT.	$Y = 182.9 + 22.4X$	578.3	.994	2.95	59.2, 24.1	3.398
41 LABOR	$Y = 5.49 + .82X$	466.1	.994	.119	43.8, 21.6	2.313
42 MAT.	$Y = 132.2 + 16.8X$	180.7	.984	3.94	31.9, 13.4	1.464
42 LABOR	$Y = 4.82 + .59X$	882.8	.997	.062	73.9, 29.7	1.742
43 MAT.	$Y = 214.3 + 18.9X$	33.8	.918	10.27	19.9, 5.1	1.475
43 LABOR	$Y = 7.63 + .62X$	964.8	.997	.063	116.2, 31.1	1.622
45 MAT.	$Y = 183.3 + 23.1X$	446.5	.993	3.46	50.6, 21.1	1.442
45 LABOR	$Y = 5.44 + .79X$	352.2	.992	.133	39.1, 18.8	2.122
46 MAT.	$Y = 207.7 + 26.4X$	1311.1	.998	2.31	85.8, 36.2	3.41
46 LABOR	$Y = 7.56 + .57X$	495.7	.994	.081	88.6, 22.3	1.700
54 MAT.	$Y = 148.1 + 16.6X$	209.3	.986	3.63	36.8, 14.5	1.420
56 MAT.	$Y = 143.1 + 38.3X$	148.5	.990	7.04	16.6, 12.2	2.581
57 MAT.	$Y = 98.99 + 10.5X$	190.3	.989	1.70	47.5, 13.8	2.145
57 LABOR	$Y = 4.68 + .38X$	16.4	.891	.208	18.4, 4.1	2.016
20 MAT.	$Y = 134.2 + 50.5X$	91.12	.968	16.7	7.7, 9.6	1.797
20 LABOR	$Y = 3.85 + 2.8X$	15.9	.951	.211	19.6, 6.1	2.131
01 MAT.	$Y = 161.7 + 26X$	431.4	.969	7.1	20.4, 9.6	1.414



TABLE B-1 (CONT.)

PREDICTING FOR 1983						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	$Y = 218.9 + 17.5X$	306.5	.990	4.55	36.3, 17.5	2.055
30 LABOR	$Y = 5.2 + .54X$	12322.0	.998	.049	101.2, 35.1	2.515
41 MAT.	$Y = 212.2 + 18.7X$	49.2	.942	8.42	24.0, 17.0	1.936
41 LABOR	$Y = 6.2 + .89X$	483.4	.994	.127	46.0, 22.0	2.606
42 MAT.	$Y = 147.0 + 16.8X$	180.7	.984	3.94	35.6, 13.4	2.23
42 LABOR	$Y = 5.34 + .61X$	3399.6	.999	.033	155.1, 58.3	2.57
43 MAT.	$Y = 253.9 + 10.4X$	8.63	.7422	11.20	21.6, 2.94	1.685
43 LABOR	$Y = 8.13 + .66X$	4014.5	.999	.033	236.1, 63.4	2.650
45 MAT.	$Y = 209.1 + 20.9X$	81.75	.965	7.30	27.3, 9.04	2.161
45 LABOR	$Y = 6.1 + .834X$	933.2	.997	.086	67.1, 30.6	3.22
46 MAT.	$Y = 245.5 + 20.8X$	36.67	.924	10.84	21.6, 6.1	2.192
46 LABOR	$Y = 7.96 + .64X$	2258.0	.997	.0424	179.2, 47.5	2.33
54 MAT.	$Y = 164.8 + 20.8X$	616.9	.995	2.65	59.3, 24.8	2.688
56 MAT.	$Y = 146.7 + 36.5X$	302.9	.990	6.63	21.1, 17.4	2.64
57 MAT.	$Y = 98.4 + 10.8X$	523.1	.994	1.49	62.8, 22.9	1.937
20 MAT.	$Y = 172.7 + 52.0X$	136.6	.979	14.06	11.7, 11.7	1.801
20 LABOR	$Y = 8.99 + .85X$	179.5	.985	.008	185.1, 40.6	2.001
01 MAT.	$Y = 186.7 + 25.4X$	260.4	.989	4.98	35.76, 16.14	1.882



TABLE B-2  
REGRESSION RESULTS FOR LOG MODEL  
N = 5

PREDICTING FOR 1981						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 160.8 + .1101X	66.7	.996	.014	359.2, 25.8	2.18
41 MAT.	Y = 188.7 + .09X	377.4	.990	.015	339.7, 19.4	2.53
42 MAT.	Y = 137.0 + .092X	422.1	.993	.014	333.2, 20.54	1.67
43 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 190.6 + .0914X	3024.0	.999	.005	951.9, 55.0	1.66
46 MAT.	Y = 214.7 + .093X	690.1	.996	.011	457.5, 26.3	2.09
54 MAT.	Y = 154.5 + .096X	1057.6	.997	.009	517.8, 32.52	1.47
56 MAT.	NONE					
57 MAT.	NONE					
20 MAT.	NONE					
01 MAT.	NONE-LINEAR	MODEL				
Fuel	Y = 221.4 + .25X	26.83	.899	.155	33.5, 5.2	1.921

PREDICTING FOR 1982						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 160.8 + .1101X	66.7	.996	.014	359.2, 25.8	2.18
41 MAT.	Y = 214.9 + .07X	39.47	.930	.036	142.6, 6.3	1.80
42 MAT.	Y = 134.3 + .092X	422.1	.993	.014	333.2, 20.6	1.67
43 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 190.6 + .091X	3024.0	.999	.005	951.86, 55.0	1.66
46 MAT.	Y = 221.4 + .093X	690.1	.996	.011	457.5, 26.3	2.09
54 MAT.	Y = 154.5 + .096X	1057.6	.997	.009	517.8, 32.5	1.47
56 MAT.	Y = 131.6 + .166X	707.9	.996	.0197	235.5, 26.6	3.57
57 MAT.	Y = 101.5 + .084X	365.6	.995	.0097	386.1, 19.1	2.37
20 MAT.	Y = 162.4 + .177X	148.5	.980	.046	105.5, 12.2	2.38
01 MAT.	NONE-LINEAR	MODEL				
Fuel	Y = 259.8 + .288X	61.19	.953	.116	45.5, 7.82	2.81



TABLE B-2 (CONT.)

PREDICTING FOR 1983						
ACCOUNT	MODEL	F-TEST	R <sup>2</sup>	SSE	t-VALUES	DURBIN-WATSON
30 MAT.	Y = 181.3 + .103X	162.40	.980	.026	193.4, 12.7	1.65
41 MAT.	Y = 214.9 + .07X	39.47	.930	.036	142.6, 6.28	1.800
42 MAT.	Y = 151.x + .086X	134.4	.980	.023	203.7, 11.6	1.900
42 MAT.	NONE-LINEAR	MODEL				
45 MAT.	Y = 212.7 + .08X	70.1	.960	.0295	173.4, 8.37	1.92
46 MAT.	Y = 249.6 + .07X	33.8	.920	.038	140.2, 5.8	2.02
54 MAT.	Y = 170.7 + .093X	406.9	.993	.0145	337.9, 20.2	2.17
56 MAT.	Y = 160.8 + .146X	194.2	.985	.033	146.6, 13.9	2.09
57 MAT.	Y = 101.5 + .083X	1013.5	.997	.008	537.6, 31.8	2.58
20 MAT.	Y = 194.4 + .166X	67.5	.960	.064	78.43, 8.22	1.48
01 MAT.	NONE-LINEAR	MODEL		.		
Fuel	Y = 387.6 + .22X	12.21	.802	.198	28.7, 3.5	1.57





TABLE B-3  
REGRESSION RESULTS  
LINEAR MODEL

ACCOUNT	1981		1982		1983	
	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICATED VALUE	STANDARD ERROR OF PREDICTION	PREDICATED VALUE	STANDARD ERROR OF PREDICTION
30 MAT.	264.48	10.486	300.7	7.313	324.02	6.591
30 LABOR	7.154	.1488	7.89	.1042	8.47	.0711
41 MAT.	290.27	7.434	317.37	4.267	324.22	12.200
41 LABOR	9.35	.1816	10.40	.1761	11.454	.1844
42 MAT.	207.59	7.016	232.70	5.712	247.5	5.712
42 LABOR	7.626	.1265	8.33	.0900	8.97	.0480
43 MAT.	321.55	9.4710	327.46	14.88	316.37	16.2315
43 LABOR	10.55	.1587	11.32	.0906	12.07	.0479
45 MAT.	290.40	5.9452	321.78	5.007	334.32	10.5792
45 LABOR	9.13	.3435	10.17	.1924	11.08	.1253
46 MAT.	334.02	5.8571	366.38	3.3462	369.95	15.7032
46 LABOR	10.27	.1612	10.99	.1183	11.78	.0608
54 MAT.	239.76	5.2612	268.06	5.6683	289.66	3.8393
56 MAT.	N/A		334.66	11.1243	369.14	11.3256
57 MAT.	N/A		151.50	2.6918	163.19	2.1643
57 LABOR	N/A		6.56	.3283	7.25	.3219
20 MAT.	N/A		437.02	24.2282	484.4	20.3698
20 LABOR	N/A		7.56		8.031	
01 MAT.	281.772	10.2830	317.51	5.7315	339.10	7.2132
Fuel	1048.903	Log Model	1454.91	Log	1441.01	Log



TABLE B-4  
REGRESSION RESULTS

LOG MODEL

ACCOUNT	1981		1982		1983	
	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICTED VALUE	STANDARD ERROR OF PREDICTION	PREDICTED VALUE	STANDARD ERROR OF PREDICTION
30 MAT.	5.60 (270.43)	.0316	5.74 (311.06)	.0200	5.81 (333.6)	.0374
41 MAT.	5.69 (295.89)	.0263	5.78 (323.76)	.0632	5.80 (330.3)	.0520
42 MAT.	5.35 (210.61)	.0316	5.47 (237.46)	.0205	5.53 (252.14)	.0332
45 MAT.	5.69 (295.89)	.0141	5.80 (329.31)	.0077	5.83 (340.36)	.0447
46 MAT.	5.84 (342.06)	.0187	5.93 (376.15)	.0173	5.93 (376.15)	.0548
54 MAT.	5.5 (244.69)	.0155	5.62 (274.79)	.0141	5.69 (295.9)	.0210
56 MAT.	N/A	N/A	5.87 (354.96)	.0286	5.96 (387.61)	.0480
57 MAT.	N/A	N/A	5.03 (152.93)	.0141	5.11 (165.67)	.0316
20 MAT.	N/A	N/A	6.15 (468.72)	.0663	6.27 (528.5)	.0949
Fuel	6.96 (1048.9)	.2245	7.28 (1454.9)	.1686	7.27 (1441.0)	.2870



TABLE B-5  
ACTUAL RESULTS FOR REGRESSION

ACCOUNT	1978	1979	1980	1981	1982
30 MAT.	196.70	221.80	250.9	279.00	294.00
30 LABOR	5.79	6.25	6.81	7.44	7.92
41 MAT.	224.18	253.44	271.75	294.87	296.82
41 LABOR	7.16	7.76	8.81	9.63	10.65
42 MAT.	163.33	178.20	199.07	218.74	226.83
42 LABOR	5.95	6.51	7.18	7.78	8.34
43 MAT.	252.68	284.04	292.30	299.90	296.80
43 LABOR	8.81	9.41	10.10	10.74	11.44
45 MAT.	227.43	249.34	274.43	301.67	305.63
45 LABOR	6.94	7.65	8.69	9.40	10.23
46 MAT.	259.90	289.20	310.50	341.30	337.60
46 LABOR	8.63	9.21	9.87	10.47	11.19
54	184.42	204.58	226.66	251.64	266.92
56	N/A	N/A	N/A	298.73	325.59
57 MAT.	N/A	N/A	N/A	141.96	152.99
57 LABOR	N/A	N/A	N/A	6.34	6.96
20 MAT.	N/A	N/A	N/A	394.56	417.37
20 LABOR	N/A	N/A	N/A	7.11	7.51
01	210.13	236.02	266.42	293.54	308.37
Fuel	397.71	682.02	864.47	1029.78	966.50



FIGURE B-1  
ALLOCATION OF COLA FUNDS  
FISCAL YEAR 1982  
RATE (AS GIVEN BY OMB) 7.8

Z(I)	CODE	DESCRIPTION	OCT1980	OCT1981	INDEX CHANGE (DECIMAL)
1	PPI 1013-02	FINISHED STEEL MILL PRODUCTS	306.3	343.7	.122102514
2	PPI 1013- 0261	STAINLESS SHEETS	222.4	235.9	.060701439
3	PPI 1025	MILL SHAPES	295.3	308.2	.043684389
4	PPI 1143	FLUID POWER EQUIP.	206.6	227.9	.103097774
5	PPI 1081	BOLTS,NUTS,SCREWS	247.1	265.9	.076082558
6	PPI 101	IRON AND STEEL	310.5	341.3	.099194847
7	PPI 1022- 0128	NICKEL,CATHODE SHEETS	400.1	400.1	0
8	PPI 117	ELECTRICAL MACHINERY AND EQUIPMENT	271.2	313.5	.155973451
9	PPI 1171	WIRING DEVICES	271.2	313.5	.155973451
10	PPI 1172	INTEGRATING AND MEASURING INSTRUMENTS	188.4	203.9	.082271762
11	PPI 1174	TRANSFORMERS,REGULATORS, POWER EQUIPMENT	192.3	217.3	.130005200
12	PPI 1175	SWITCHGEAR, SWITCHBOARD EQUIPMENT	236.8	252.9	.067989865
13	PPI 1178	ELECTRONIC COMPONENTS AND ACCESSORIES	160.6	170.6	.062266501
14	PPI 08	LUMBER AND WOOD PRODUCTS	289.0	284.3	-.016262976





15	PPI 10	METALS AND METAL PRODUCTS	291.9	305.3	.045906132
16	PPI 1322	CEMENT	311.7	330.2	.059351941
17	PPI 107	METAL PRODUCTS, FABRICATED STRUCTURAL	276.9	302.6	.092813290
18	PPI 114	GENERAL PURPOSE MACHINERY AND EQUIPMENT	272.5	295.1	.082935779
19	PPI 1392	INSULATION MATERIALS	300.0	346.8	.156000000
20	PPI 1513C1	SMALL ARMS	228.7	258.6	.130738959
21	PPI 1513C2	SMALL ARMS AMMUNITION	225.3	247.0	.096316025
22	PPI 05	FUELS AND RELATED POWER PRODUCTS	592.9	698.1	.177432957
23	PPI 0712C1	TIRES	244.0	255.6	.047540984
24	PPI 1411C2	MOTOR TRUCKS	249.3	279.3	.120336943
25	PPI TABLE (USUALLY #9)	TOTAL RAILROAD FREIGHT	299.0	337.9	.130100334
26	PPI TABLE (USUALLY #11)	POSTAL SERVICE	N/A	138.7	N/A
27	PPI 0571	GASOLINE	642.1	723.5	.126771531
28	PPI 0572	LIGHT DISTILLATES	896.3	1042.7	.163338168
29	PPI 0573	MIDDLE DISTILLATES	868.4	1056.1	.216144634
30	PPI 0574	RESIDUAL FUELS	943.8	1179.1	.249311295
31	AHE	MANUFACTURING	7.02	7.72	.099715099
32	AHE 3721	AIRCRAFT INDUSTRY	10.05	10.86	.080597015
33	AHE 3728	AIRCRAFT PARTS AND EQUIPMENT	8.64	9.54	.104166667
34	AHE 3724	AIRCRAFT PARTS	9.65	10.59	.097409326



35	AHE 366	COMMUNICATIONS EQUIP.	8.20	9.11	.110975609
36	AHE 367	ELECTRONIC COMPONENTS AND ACCESSORIES	6.23	6.75	.083467095
37	AHE 36	ELECTRICAL EQUIPMENT AND SUPPLIES	7.18	7.78	.083565459
38	AHE 17	SPECIAL TRADE (SKILLED LABOR)	10.96	11.72	.069343066
39	AHE 15	GENERAL BUILDING (UNSKILLED LABOR)	9.40	9.93	.056382979
40	AHE 373	SHIP/BOAT BUILDING AND REPAIR	8.51	9.02	.059529495
41	AHE 3731	SHIP BUILDING AND REPAIR	8.87	9.78	.102593010
42	AHE 384	MEDICAL INSTRUMENTS AND SUPPLIES	5.98	6.61	.105351171
43	AHE 421	TRUCKING AND TRUCKING TERMINALS	9.69	10.34	.067079463
44	AHE 422	PUBLIC TERMINALS	6.38	7.04	.103448276
45	AHE 73	BUSINESS SERVICES	6.10	6.63	.086885246
46	AHE 372	AIRCRAFT AND PARTS	9.60	10.48	.091666667
47	AHE	RETAIL AND WHOLESALE	5.48	5.92	.080291971
48	AHE	TRANSPORTATION	8.87	9.70	.093573844
49	AHE	SERVICES	5.85	6.41	.095726490
50	CPI INDEX	TOTAL CPI INDEX LESS FOOD	250.9	279.0	.111990811
51	CPI INDEX	AIRLINE FARES	315.0	372.0	.180952381
52	CPI INDEX	INTERCITY BUS FARE	307.1	361.3	.176489743
53	CPI INDEX	INTERCITY MASS TRANSIT	235.6	301.7	.280560272



54	CPI INDEX	TAXI FARE	267.9	289.3	.079880552
55	CPI INDEX	INTERCITY TRAIN FARE	255.6	315.0	.232394366
56	CPI INDEX	LODGING WHILE OUT OF TOWN	286.0	324.2	.133566434
57	CPI INDEX	FOOD AWAY FROM HOME	273.1	296.2	.084584401
58	CPI INDEX	TUITION AND OTHER SCHOOL FEES	132.4	149.3	.127643504
59	CPI INDEX	NONPRESCRIPTION MEDICAL EQUIPMENT AND SUPPLIES	121.3	132.7	.093981863
60	CPI INDEX	HOUSING	271.1	303.5	.119513095
61	CPI INDEX	FOOD AND BEVERAGE	255.5	270.3	.057925636



FIGURE B-2

FISCAL YEAR 1982

THIS YEAR'S BASE(LAST YEAR'S BUDGET)

OG ACCOUNT	THIS YEAR'S BASE(LAST YEAR'S BUDGET)
30	31042300C
41	4539000C
42	5567500C
43	3873300C
45	4902100C
46	968300C
54	302600C
56	1452500C
57	1847300C
20	2420800C
01	544800C
FUEL	4054500C

TOTAL NON-PAY CE EASE 605204000  
COLA AMOUNT IN DOLLARS(TOTAL NON-PAY OE BASE TIMES COLA RATE) 47205912





FIGURE B-3  
ALLOCATION OF COLA FUNDS  
FISCAL YEAR 1982  
COLA RATE (AS GIVEN BY OMB) 7.8

ACCOUNT	1981 (ACTUAL)	1982 (PREDICTED)	INDEX (PERCENT)
0630 MATERIAL	275.00	300.70	.0778
0630 LABOR	7.44	7.89	.0605
0641 MATERIAL	294.87	317.37	.0763
0641 LABOR	9.63	10.39	.0789
0642 MATERIAL	218.74	232.70	.0638
0642 LABOR	7.78	8.33	.0737
0643 MATERIAL	299.90	327.46	.0919
0643 LABOR	10.74	11.32	.0540
0645 MATERIAL	301.67	321.78	.0667
0645 LABOR	9.40	10.17	.0819
0646 MATERIAL	341.30	366.38	.0735
0646 LABOR	10.47	11.00	.0506
0654	251.64	268.06	.0653
0656	298.73	334.66	.1203
0657 MATERIAL	141.96	151.50	.0672
0657 LABOR	6.34	6.56	.0347
0620 MATERIAL	394.55	437.02	.1076
0620 LABOR	7.11	7.56	.0633
0601	293.54	317.51	.0817
FUEL	1029.78	1454.91	.4157



FIGURE B-4

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LT. KEVIN G. ROSS      USCG
01 OCTOBER, 1983
PROGRAM NUMBER ONE (1)
THIS PROGRAM COMPUTES THE INDIVIDUAL RATES FOR EACH ACCOUNT
AND ALLCCATES COLA FUNDS BASED ON THOSE RATES.
READ IN PERCENT CHANGES (AS DECIMALS) FOR ALL 61 INDEXES.
FIELD IS SET UP FOR VALUES WITH 19 DECIMAL PLACES.
READ IN COLA IN PERCENT FORM (NOT DECIMAL).
READ IN BASE FOR EACH ACCOUNT AND TOTAL BASE FOR NON-PAY OE.

INTEGER I
DOUBLE PRECISION CGLA, Z(61), FP, AFM, AVI, TONEED,
*EL, ELL, NEED30, NEED41, NEED42, NEED43,
*EC, CE, NE, OE, SA, PT, MED, TVL, TF, RFP, PS, AF, TRANS, TVLTRA,
*HGM, FUEL, B(12), T08, ASE, COLA$, T0P, BUD30, WT,
*BUD41, BUD42, BUD43, BUD45, BUD46, BUD54, BUD56, BUD57, BUD20,
*BUD01, BUDFUL, OG30, OG41, OG42, OG43, OG45, OG46, OG54, OG56,
*OG57, OG2C, OG01, OFUEL, T0COLA, AFL, M, ELM, EM, I01, I77,
*I30, I41, I42, I43, I45, I46, I54, I56, I57, I20, NEED01,
*NEED45, NEED46, NEED54, NEED56, NEED57, NEED20, NEED01,
*NEED77, TQDIFF, PERDIF, GOT30, GOT41, GOT42, GOT43, GOT45,
*GOT46, GCI54, GOT56, GOT57, GOT120, GOT01, GOT77, TFM, TFL, PSM,
*PSL, AFL, TRANM, TRANL, TVLTRM

TOP-OF-FGRM
WRITE (6,90C)

OUTPUT MAIN HEADING
WRITE (6,20C)

READ IN CPI/PPI/AHE CODES FOR COMMODITIES AS DECIMALS
DO 10 I=1,61
  READ (2,100) Z(I)
CONTINUE

READ (3,101) COLA
INDIVIDUAL TOTALS

OG30  FINANCIAL PROCUREMENT
FP= (.5*(Z(50))) + (.5*( (.25*(Z(31))) + (.25*(Z(47))) + (.25*(Z(48))) )
*+ (.25*(Z(49))))

OG 41  AVIATION

AIR FRAME

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CCCCCCCCCCCC
CC
CC
CC
CC
10
CC
CC
CC
CCCC

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AFM=.62\*((.2\*(Z(1)))+(0.1\*(Z(2)))+(0.2\*(Z(3)))+(0.1\*(Z(4)))  
 \*+(0.1\*(Z(5)))+(0.3\*(Z(6))))  
 ENGINE  
 EM=.19\*((.6\*(Z(6)))+(0.1\*(Z(7)))+(0.2\*(Z(3)))  
 \*+(0.1\*(Z(8))))  
 ELECTRICAL  
 ELM=.19\*(Z(8))  
 TOTAL MATERIAL  
 M=.42\*(AFM+EM+ELM)  
 LABOR  
 AIR FRAME  
 AFL=.5\*((.6\*(Z(32)))+(0.4\*(Z(33))))  
 ENGINE  
 EL=.2\*(Z(34))  
 ELECTRICAL  
 ELL=.3\*((.45\*(Z(35)))+(0.55\*(Z(36))))  
 TOTAL FIXED WING LABOR  
 L=.58\*(AFL+EL+ELL)  
 TOTAL AVIATION  
 AVI=L+M  
 OG42 ELECTRONICS/COMMUNICATIONS  
 EC=(.4\*((.2\*(Z(9)))+(0.2\*(Z(10)))+(0.1\*(Z(11)))+(0.1\*(Z(12)))  
 \*+(0.4\*(Z(13))))+(0.6\*(Z(37)))  
 OG43 CIVIL ENGINEERING  
 CE=(.44\*((.24\*(Z(14)))+(0.59\*(Z(15)))+(0.07\*(Z(16))))+  
 \*+(.56\*((.45\*(Z(38)))+(0.55\*(Z(39))))  
 OG45 NAVAL ENGINEERING  
 NE=(.4\*((.3\*(Z(6)))+(0.2\*(Z(17)))+(0.2\*(Z(18)))+(0.2\*(Z(8)))  
 \*+(0.1\*(Z(19))))+(0.6\*((.4\*(Z(40)))+(0.5\*(Z(41)))+(0.1\*(Z(37))))  
 OG46 OCEAN ENGINEERING  
 OE=(.4\*((.8\*(Z(6)))+(0.2\*(Z(13)))+(0.6\*((.3\*(Z(38)))+(0.6\*(Z(39)))  
 \*+(0.1\*(Z(37))))  
 OG54 SMALL ARMS  
 SA=(.4\*(Z(20)))+(0.6\*(Z(21)))

COL0C490  
 COL0C500  
 COL0C510  
 COL0C520  
 COL0C530  
 COL0C540  
 COL0C550  
 COL0C560  
 COL0C570  
 COL0C580  
 COL0C590  
 COL0C600  
 COL0C610  
 COL0C620  
 COL0C630  
 COL0C640  
 COL0C650  
 COL0C660  
 COL0C670  
 COL0C680  
 COL0C690  
 COL0C700  
 COL0C710  
 COL0C720  
 COL0C730  
 COL0C740  
 COL0C750  
 COL0C760  
 COL0C770  
 COL0C780  
 COL0C790  
 COL0C800  
 COL0C810  
 COL0C820  
 COL0C830  
 COL0C840  
 COL0C850  
 COL0C860  
 COL0C870  
 COL0C880  
 COL0C890  
 COL0C900  
 COL0C910  
 COL0C920  
 COL0C930  
 COL0C940  
 COL0C950



C	OG56	PERSONNEL TRAINING		COL000970
C			PT = (.5*(.6*(Z(51)))+(0.1*(Z(52)))+(0.1*(Z(53)))+	COL000980
			*(.1*(Z(54)))+(0.1*(Z(55)))+(0.3*(.6*(Z(56)))+(	COL000990
			*(.4*(Z(57)))+(0.2*(Z(58)))	COL001000
C	OG57	MEDICAL		COL001010
C			MED = (.5*(.9*(Z(59)))+(0.1*(Z(13)))+(0.5*(.2*(Z(37))	COL001020
C			*)+(.8*(Z(42))))	COL001030
C	OG20	TRAVEL AND TRANSPORTATION (PCS)		COL001040
C		TRAVEL		COL001050
C			TVL = (.5*(.6*(Z(51)))+(0.2*(Z(55)))+(0.1*(Z(52)))+(0.1*(Z(53)))+(	COL001060
C			*(.5*(.7*(Z(56)))+(0.3*(Z(57))))	COL001070
C		TRANSPORTATION		COL001080
C		TRUCK FREIGHT		COL001090
C			TFM = (.7*(Z(22)))+(0.1*(Z(23)))+(0.2*(Z(24)))+(	COL001100
C			TFL = (.5*(Z(43)))+(0.5*(Z(44)))+(	COL001110
C		RAIL FREIGHT		COL001120
C			RAF = (Z(25))	COL001130
C		POSTAL SERVICE		COL001140
C			PSM = (Z(26))	COL001150
C			PSL = (Z(45))	COL001160
C		AIR FREIGHT		COL001170
C			AFM = (Z(22))	COL001180
C			AFL = (.4*(Z(37)))+(0.6*(Z(46)))+(	COL001190
C		TOTAL TRANSPORTATION		COL001200
C			TRANM = (.6*(TFM))+(0.2*(RF))+(0.1*(PSM))+(0.1*(AFM))	COL001210
C			TRANL = (.6*(TFL))+(0.2*(PSL))+(0.2*(AFL))	COL001220
C		TOTAL TRAVEL AND TRANSPORTATION		COL001230
C			TVLTRM = (.5*TRANM)+(0.5*TVL)	COL001240
C			TVLTRA = (.6*TRANL)+(0.4*TVLTRM)	COL001250
C	OG01	HCLSIING AND GENERAL MESS		COL001260
C			HGM = (.7*(Z(60)))+(0.3*(Z(61)))+(	COL001270
C		FUEL		COL001280
C			FUEL = (.1*(Z(27)))+(0.4*(Z(28)))+(0.4*(Z(29)))+(0.1*(Z(30)))+(	COL001290
C				COL001300
C		WRITE (6,201) FP		COL001310
C		WRITE (6,202) FP		COL001320
C		WRITE (6,203) AVI		COL001330
C		WRITE (6,204) EC		COL001340
				COL001350
				COL001360
				COL001370
				COL001380
				COL001390
				COL001400
				COL001410
				COL001420
				COL001430
				COL001440





COL01450  
COL01460  
COL01470  
COL01480  
COL01490  
COL01500  
COL01510  
COL01520  
COL01530  
COL01540  
COL01550  
COL01560  
COL01570  
COL01580  
COL01590  
COL01600  
COL01610  
COL01620  
COL01630  
COL01640  
COL01650  
COL01660  
COL01670  
COL01680  
COL01690  
COL01700  
COL01710  
COL01720  
COL01730  
COL01740  
COL01750  
COL01760  
COL01770  
COL01780  
COL01790  
COL01800  
COL01810  
COL01820  
COL01830  
COL01840  
COL01850  
COL01860  
COL01870  
COL01880  
COL01890  
COL01900  
COL01910  
COL01920

WR ITE (6,205) CE  
WR ITE (6,206) NE  
WR ITE (6,207) OE  
WR ITE (6,208) SA  
WR ITE (6,209) PT  
WR ITE (6,210) MED  
WR ITE (6,211) TVLTRA  
WR ITE (6,212) HGM  
WR ITE (6,213) FUEL

END INDIVIDUAL CG MODELS

READ IN LAST YEARS BUDGET (THIS YEAR'S BASE) FOR EACH UG ACCOUNT

DO 12 I=1,12  
READ (4,102) B(I)

CONTINUE  
READ IN TOTAL OE NGN-PAY BASE  
READ (3,103) TOBASE

WR ITE (6,900)  
WR ITE (6,215) B(1)  
WR ITE (6,216) B(2)  
WR ITE (6,217) B(3)  
WR ITE (6,218) B(4)  
WR ITE (6,219) B(5)  
WR ITE (6,220) B(6)  
WR ITE (6,221) B(7)  
WR ITE (6,222) B(8)  
WR ITE (6,223) B(9)  
WR ITE (6,224) B(10)  
WR ITE (6,225) B(11)  
WR ITE (6,226) B(12)

CALCULATE ACTUAL FUNDS NEEDED BY EACH ACCOUNT

NEED30=FP\*B(1)  
NEED41=AVI\*B(2)  
NEED42=EC\*B(3)  
NEED43=CE\*B(4)  
NEED45=NE\*B(5)  
NEED46=CE\*B(6)  
NEED54=SA\*B(7)  
NEED56=PT\*B(8)  
NEED57=NED\*B(9)  
NEED20=TVLTFAB(10)  
NEED01=FGM\*B(11)



COL01930  
COL01940  
COL01950  
COL01960  
COL01970  
COL01980  
COL01990  
COL02000  
COL02010  
COL02020  
COL02030  
COL02040  
COL02050  
COL02060  
COL02070  
COL02080  
COL02090  
COL02100  
COL02110  
COL02120  
COL02130  
COL02140  
COL02150  
COL02160  
COL02170  
COL02180  
COL02190  
COL02200  
COL02210  
COL02220  
COL02230  
COL02240  
COL02250  
COL02260  
COL02270  
COL02280  
COL02290  
COL02300  
COL02310  
COL02320  
COL02330  
COL02340  
COL02350  
COL02360  
COL02370  
COL02380  
COL02390  
COL02400

```

NEED77=FUEL*B(12)
WRITE (6,247) NEED30
WRITE (6,216) NEED41
WRITE (6,217) NEED42
WRITE (6,218) NEED43
WRITE (6,219) NEED45
WRITE (6,220) NEED46
WRITE (6,221) NEED54
WRITE (6,222) NEED56
WRITE (6,223) NEED57
WRITE (6,224) NEED20
WRITE (6,225) NEED01
WRITE (6,226) NEED01
WRITE (6,227) NEED77

CALCULATE TCTAL AMCUNT OF OF COLA ACTUALLY NEEDED BY CG.
TONEED=NEED30+NEED41+NEED42+NEED43+NEED45+NEED46+NEED54+
*NEED56+NEED57+NEED20+NEED01+NEED77
WRITE (6,248) TCNEED

READ IN COLA AMCUNT IN DOLLARS
READ (3,104) COLA$

THE AGGREGATE MODEL

I30=(FPI)*B(1)
I41=(AVI)*B(2)
I42=(EC)*B(3)
I43=(CE)*B(4)
I45=(NE)*B(5)
I46=(OE)*B(6)
I54=(SA)*B(7)
I56=(PT)*B(8)
I57=(MED)*B(9)
I20=(TVLTRA)*B(10)
I01=(HGM)*B(11)
I77=(FUEL)*B(12)

CHECK FCR NEGATIVE COST OF LIVING
IF (FP.LT.0.0) I30=0.0
IF (AVI.LT.0.0) I41=0.0
IF (EC.LT.0.0) I42=0.0
IF (CE.LT.0.0) I43=0.0
IF (NE.LT.0.0) I45=0.0
IF (OE.LT.0.0) I46=0.0
IF (SA.LT.0.0) I54=0.0
IF (PT.LT.0.0) I56=0.0
IF (MED.LT.0.0) I57=0.0

```

C C C C C C C



IF (TVLTRA.LT.0.0) I20=0.0	COL02410
IF (HGM.LT.C.0) I01=0.0	COL02420
IF (FUEL.LT.0.0) I77=0.0	COL02430
	COL02440
TOP= (I30)+(I41)+(I42)+(I43)+(I45)+(I46)+(I54)+(I56)+	COL02450
*(I57)+(I20)+(I01)+(I77)	COL02460
CALCULATE THE INDIVIDUAL COLA AMOUNTS	COL02470
	COL02480
	COL02490
WT=(TOBASE*(COLA/100.0))	COL02500
BUD30= (I30/TOP)*WT	COL02510
BUD41= (I41/TOP)*WT	COL02520
BUD42= (I42/TOP)*WT	COL02530
BUD43= (I43/TOP)*WT	COL02540
BUD45= (I45/TOP)*WT	COL02550
BUD46= (I46/TOP)*WT	COL02560
BUD54= (I54/TOP)*WT	COL02570
BUD56= (I56/TOP)*WT	COL02580
BUD57= (I57/TOP)*WT	COL02590
BUD20= (I20/TOP)*WT	COL02600
BUD01= (I01/TOP)*WT	COL02610
BUDFUL= (I77/TOP)*WT	COL02620
DETERMINE CCLA AMOUNTS	COL02630
	COL02640
OG30= BUD30	COL02650
OG41= BUD41	COL02660
OG42= BUD42	COL02670
OG43= BUD43	COL02680
OG45= BUD45	COL02690
OG46= BUD46	COL02700
OG54= BUD54	COL02710
OG56= BUD56	COL02720
OG57= BUD57	COL02730
OG20= BUD20	COL02740
OG01= BUD01	COL02750
OFUEL= BUDFUL	COL02760
	COL02770
WR ITE (6,90C)	COL02780
WR ITE (6,231)	COL02790
WR ITE (6,216)	COL02800
WR ITE (6,217)	COL02810
WR ITE (6,218)	COL02820
WR ITE (6,219)	COL02830
WR ITE (6,220)	COL02840
WR ITE (6,221)	COL02850
WR ITE (6,222)	COL02860
WR ITE (6,223)	COL02870
WR ITE (6,224)	COL02880



C	WRITE (6,225) OG20	COL02890
	WRITE (6,226) OG01	COL02900
	WRITE (6,227) OFUEL	COL02910
	CALCULATE TCTAL COLA RECEIVED BY CG AS COMPUTED BY PROGRAM	COL02920
	TOTCOLA=CG3C+OG41+OG42+OG43+OG45+OG46+CG54+CG56+OG57+OG620	COL02930
	*+OG01+CFUEL	COL02940
C	WRITE (6,246) TCCOLA	COL02950
C	DIFFERENCE BETWEEN COLA RECEIVED AND COLA NEEDED	COL02960
C	TODIFF=TCNEED-CCLA\$	COL02970
	WRITE(6,249) TODIFF	COL02980
C	PERCENT DIFFERENCE	COL02990
	PERDIF=COLA1/TONEED	COL03000
	WRITE(6,250) PERDIF	COL03010
C		COL03020
C	PERFORM CHECK TO ENSURE ALL COLA IS ALLOCATED	COL03030
C	DIFFERENCE BETWEEN COLA ALLOCATED BY PROGRAM AND COLA RECEIVED.	COL03040
	DICOLA=COLA\$-TCCOLA	COL03050
	WRITE (6,245) DICOLA	COL03060
	GOT30=CG30/NEED30	COL03070
	GOT41=OG41/NEED41	COL03080
	GOT42=CG42/NEED42	COL03090
	GOT43=OG43/NEED43	COL03100
	GOT45=CG45/NEED45	COL03110
	GOT46=CG46/NEED46	COL03120
	GOT54=OG54/NEED54	COL03130
	GOT56=CG56/NEED56	COL03140
	GOT57=OG57/NEED57	COL03150
	GOT20=OG20/NEED20	COL03160
	GOT01=CG01/NEED01	COL03170
	GOT77=CFUEL/NEED77	COL03180
	WRITE (6,263)	COL03190
	WRITE (6,251) GOT30	COL03200
	WRITE (6,252) GOT41	COL03210
	WRITE (6,253) GOT42	COL03220
	WRITE (6,254) GOT43	COL03230
	WRITE (6,255) GOT45	COL03240
	WRITE (6,256) GOT46	COL03250
	WRITE (6,257) GOT54	COL03260
	WRITE (6,258) GOT56	COL03270
	WRITE (6,259) GOT57	COL03280
	WRITE (6,260) GOT20	COL03290
	WRITE (6,261) GOT01	COL03300
	WRITE (6,262) GOT77	COL03310
		COL03320
		COL03330
		COL03340
		COL03350
		COL03360
C	EJECT PAGE	
C	WRITE (6,500)	





COL03370  
COL03380  
COL03390  
COL03400  
COL03410  
COL03420  
COL03430  
COL03440  
COL03450  
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COL03470  
COL03480  
COL03490  
COL03500  
COL03510  
COL03520  
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COL03600  
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COL03680  
COL03690  
COL03700  
COL03710  
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COL03730  
COL03740  
COL03750  
COL03760  
COL03770  
COL03780  
COL03790  
COL03800  
COL03810  
COL03820  
COL03830  
COL03840

STCP	FORMAT	STATEMENTS
100	FORMAT	(F12.9)
101	FORMAT	(F8.4)
102	FORMAT	(F14.2)
103	FORMAT	(F16.2)
104	FORMAT	(F14.2)
1900	FORMAT	(.1.)
200	FORMAT	(.0.)
201	FORMAT	(.0.)
202	FORMAT	(.0.)
203	FORMAT	(.0.)
204	FORMAT	(.0.)
205	FORMAT	(.0.)
206	FORMAT	(.0.)
207	FORMAT	(.0.)
208	FORMAT	(.0.)
209	FORMAT	(.0.)
210	FORMAT	(.0.)
211	FORMAT	(.0.)
212	FORMAT	(.0.)
213	FORMAT	(.0.)
214	FORMAT	(.0.)
215	FORMAT	(.0.)
216	FORMAT	(.0.)
217	FORMAT	(.0.)
218	FORMAT	(.0.)
219	FORMAT	(.0.)
220	FORMAT	(.0.)
221	FORMAT	(.0.)
222	FORMAT	(.0.)
223	FORMAT	(.0.)
224	FORMAT	(.0.)
225	FORMAT	(.0.)
226	FORMAT	(.0.)
227	FORMAT	(.0.)
228	FORMAT	(.0.)
229	FORMAT	(.0.)
230	FORMAT	(.0.)
231	FORMAT	(.0.)
232	FORMAT	(.0.)
233	FORMAT	(.0.)
234	FORMAT	(.0.)
235	FORMAT	(.0.)
236	FORMAT	(.0.)
237	FORMAT	(.0.)
238	FORMAT	(.0.)
239	FORMAT	(.0.)
240	FORMAT	(.0.)
241	FORMAT	(.0.)
242	FORMAT	(.0.)
243	FORMAT	(.0.)
244	FORMAT	(.0.)
245	FORMAT	(.0.)
246	FORMAT	(.0.)
247	FORMAT	(.0.)
248	FORMAT	(.0.)
249	FORMAT	(.0.)
250	FORMAT	(.0.)
251	FORMAT	(.0.)
252	FORMAT	(.0.)
253	FORMAT	(.0.)

ALLOCATION OF COLA FUNDS 198X.)  
COST OF LIVING.)  
OG-30., 2X, F9.6)  
OG-41., 2X, F9.6)  
OG-42., 2X, F9.6)  
OG-43., 2X, F9.6)  
OG-45., 2X, F9.6)  
OG-46., 2X, F9.6)  
OG-54., 2X, F9.6)  
OG-56., 2X, F9.6)  
OG-57., 2X, F9.6)  
OG-20., 2X, F9.6)  
OG-01., 2X, F9.6)  
FUEL., 2X, F9.6)  
BASE FOR INDIVIDUAL OG ACCOUNTS.)  
OG-30., 2X, F14.2)  
OG-41., 2X, F14.2)  
OG-42., 2X, F14.2)  
OG-43., 2X, F14.2)  
OG-45., 2X, F14.2)  
OG-46., 2X, F14.2)  
OG-54., 2X, F14.2)  
OG-56., 2X, F14.2)  
OG-57., 2X, F14.2)  
OG-20., 2X, F14.2)  
OG-01., 2X, F14.2)  
FUEL., 2X, F14.2)  
COLA AMOUNTS FOR EACH OG ACCOUNT.)  
MONEY LEFT TO ALLOCATE., 2X, F14.2)  
TOTAL COLA ALLOCATED., 2X, F16.2)  
TOTAL FUNDS ALLOCATED FOR INFLATION.)  
ACTUAL FUNDS NEEDED., 2X, F14.2)  
TOTAL ACTUAL FUNDS NEEDED AND COLA  
RECEIVED., 2X, F14.2)  
PER CENT DIFFERENCE., 2X, F8.6)  
OG-30., 2X, F8.6)  
OG-41., 2X, F8.6)  
OG-42., 2X, F8.6)



4567890123  
5555556666  
2222222222

```

FORMAT (0, 'OG-43', 2X, F8.6)
FORMAT (0, 'OG-45', 2X, F8.6)
FORMAT (0, 'OG-46', 2X, F8.6)
FORMAT (0, 'OG-54', 2X, F8.6)
FORMAT (0, 'OG-56', 2X, F8.6)
FORMAT (0, 'OG-57', 2X, F8.6)
FORMAT (0, 'OG-20', 2X, F8.6)
FORMAT (0, 'OG-01', 2X, F8.6)
FORMAT (0, 'FUEL', 2X, F8.6)
FORMAT (0, 'PER CENT OF ACTU
*EACH ACCOUN.)
END

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[illegible]



FIGURE B-5

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C LT KEVIN G. ROSS USCG
C 01 OCTOBER, 1983
C PROGRAM NUMBER TWO (2)
C THIS PROGRAM COMPUTES THE INDIVIDUAL MATERIAL AND LABOR INDEXES
C FOR EACH OF THE INDIVIDUAL OG ACCOUNTS.
C THE INDEXES OBTAINED IN THIS PROGRAM WILL BE INPUTTED INTO
C A REGRESSION PROGRAM.
C READ IN THE 61 INDEXES AS COPIED FROM BLS PUBLICATIONS.
C
C INTEGER I
C DOUBLE PRECISION Z(61),AFM,
C *EL,ELL,FP2,A1,A2,FP1,EC1,EC2,CE1,CE2,NE1,NE2,OE1,OE2,
C *SA,PT,MEC1,MED2,RF,PS1,PS2,TF1,TVL,TF2,AF1,AF2,TRANS1,
C *HGM,FUEL,TVLTR1,TVLTR2,ELM,EM
C
C TOP-OF-FCRM
C WRITE (6,90C)
C
C OUTPUT MAIN HEADING
C WRITE (6,20C)
C
C READ IN CPI/PPI/AHE CODES FOR COMMODITIES
C DO 10 I=1,61
C   READ (2,100) Z(I)
C   CONTINUE
C
C INDIVIDUAL TOTALS
C
C OG30 FINANCIAL PRCCURMENT
C FP1=(Z(50))
C FP2=(.25*(Z(31)))+(0.25*(Z(47)))+(0.25*(Z(48)))+(0.25*(Z(49)))
C
C OG 41 AVIATION
C
C AIR FRAME
C AFM=.62*(.2*(Z(1)))+(0.1*(Z(2)))+(0.2*(Z(3)))+(0.1*(Z(4))
C *+(0.1*(Z(5)))+(0.3*(Z(6)))
C ENGINE
C EM=.19*(.6*(Z(6)))+(0.1*(Z(7)))+(0.2*(Z(3)))
C *+(0.1*(Z(8)))
C ELECTRICAL
C ELM=.15*(Z(8))
C TOTAL MATERIAL
C A1=(AFM+EM+ELM)

```



C	LABOR	COL0C490
C	AIR FRAME	COL00500
C	AFL= .5*( (.6*(Z(32)))+( .4*(Z(33))) )	COL0C510
C	ENGINE	COL00520
C	EL= .2*(Z(34))	COL00530
C	ELECTRICAL	COL00540
C	ELL= .3*( (.45*(Z(35)))+( .55*(Z(36))) )	COL00550
C	TOTAL FIXED WING LABOR	COL0C560
C	A2=(AFL+EL+ELL)	COL0C570
C		COL0C580
C		COL0C590
C		COL00600
C		COL00610
C		COL00620
C		COL0C630
C		COL00640
C		COL0C650
C		COL00660
C		COL0C670
C		COL00680
C		COL00690
C		COL0C700
C		COL00710
C		COL0C720
C		COL0C730
C		COL00740
C		COL0C750
C		COL0C760
C		COL00770
C		COL0C780
C		COL0C790
C		COL0C800
C		COL0C810
C		COL00820
C		COL0C830
C		COL00840
C		COL0C850
C		COL0C860
C		COL0C870
C		COL0C880
C		COL0C890
C		COL00900
C		COL0C910
C		COL00920
C		COL00930
C		COL0C940
C		COL00950
C		COL0C960

	OG42 ELCTRCNICS/COMMUNICATIONS	
	EC1=(.2*(Z(9)))+( .2*(Z(10)))+( .1*(Z(11)))+( .1*(Z(12)))	
	*+(.4*(Z(13)))	
	EC2=(Z(37))	
	OG43 CIVIL ENGINEERING	
	CE1=(.24*(Z(14)))+( .59*(Z(15)))+( .07*(Z(16)))	
	CE2=(.45*(Z(38)))+( .55*(Z(39)))	
	OG45 NAVAL ENGINEERING	
	NE1=(.3*(Z(6)))+( .2*(Z(17)))+( .2*(Z(18)))+( .2*(Z(8)))	
	*+(.1*(Z(19)))	
	NE2=(.4*(Z(40)))+( .5*(Z(41)))+( .1*(Z(37)))	
	OG46 OCEAN ENGINEERING	
	OE2=(.3*(Z(28)))+( .6*(Z(39)))+( .1*(Z(37)))	
	OE1=(.8*(Z(6)))+( .2*(Z(13)))	
	OG54 SMALL ARMS	
	SA= (.4*(Z(20)))+( .6*(Z(21)))	
	OG56 PERSONNEL TRAINING	
	PT= (.5*( (.6*(Z(51)))+( .1*(Z(52)))+( .1*(Z(53))) ) +	
	*(.1*(Z(4)))+( .1*(Z(55))) )+( .3*( (.6*(Z(56))) ) +	
	*(.4*(Z(57))) )+( .2*(Z(58)))	
	OG57 MEDICAL	
	MED1=(.5*(Z(59)))+( .1*(Z(13)))	
	MED2=(.2*(Z(37)))+( .8*(Z(42)))	









COL01450  
 COL01460  
 COL01470  
 COL01480  
 COL01490  
 COL01500  
 COL01510  
 COL01520  
 COL01530  
 COL01540  
 COL01550  
 COL01560  
 COL01570  
 COL01580  
 COL01590  
 COL01600  
 COL01610  
 COL01620  
 COL01630  
 COL01640  
 COL01650  
 COL01660  
 COL01670  
 COL01680  
 COL01690

END INDIVIDUAL CG MODELS  
 EJECT PAGE  
 WRITE (6,90C)  
 STOP  
 FORMAT STATEMENTS  
 (F7.3)  
 (1.1), ALLOCATION OF COLA FUNDS 198X.)  
 (0.0), COST OF LIVING.)  
 (0.0), CG-30, 2X,2F7.3)  
 (0.0), CG-41, 2X,2F7.3)  
 (0.0), CG-42, 2X,2F7.3)  
 (0.0), CG-43, 2X,2F7.3)  
 (0.0), CG-45, 2X,2F7.3)  
 (0.0), CG-46, 2X,2F7.3)  
 (0.0), CG-54, 2X,2F7.3)  
 (0.0), CG-56, 2X,2F7.3)  
 (0.0), CG-57, 2X,2F7.3)  
 (0.0), CG-20, 2X,2F7.3)  
 (0.0), CG-01, 2X,2F7.3)  
 (0.0), FUEL, 2X,2F9.3)  
 END

C 100  
 C 200  
 C 201  
 C 202  
 C 203  
 C 204  
 C 205  
 C 206  
 C 207  
 C 208  
 C 209  
 C 210  
 C 211  
 C 212  
 C 213



FIGURE B-6

COL0C010  
COL00020  
COL0C030  
COL00040  
COL00050  
COL0C060  
COL00070  
COL0C080  
COL0C090  
COL0C100  
COL0C110  
COL00120  
COL00130  
COL00140  
COL00150  
COL00160  
COL0C170  
COL00180  
COL0C190  
COL0C200  
COL0C210  
COL0C220  
COL00230  
COL0C240  
COL00250  
COL00260  
COL0C270  
COL00280  
COL0C290  
COL0C300  
COL00310  
COL0C320  
COL00330  
COL00340  
COL0C350  
COL00360  
COL0C370  
COL0C380  
COL0C390  
COL0C400  
COL0C410  
COL0C420  
COL0C430  
COL00440  
COL0C450  
COL0C460  
COL00470  
COL0C480

```

LT. KEVIN G. ROSS USC
01 OCTOBER 1983
PROGRAM NUMBER THREE (3)
THIS PROGRAM COMPUTES THE COLA ALLOCATION FOR EACH ACCOUNT.
INSERT THE VALUES OF THE INFLATION RATES AS COMPUTED FROM
THE REGRESSION EQUATIONS. INSET THESE VALUES STRAIGHT INTO
THE PROGRAM.
READ IN THE INDIVIDUAL BASE TOTALS.
READ IN COLA AS A PERCENT AND AS A DOLLAR FIGURE.
READ IN TOTAL BASE FOR NON-PAY CE.

INTEGER I
DOUBLE PRECISION COLA, Z(61), FP, NEED30, NEED41,
NEED30, NEED41, NEED42, NEED43, AVI, NEED42, NEED43,
*EC, CE, NE, CE, SA, FT, MED, TVLTRA,
*HGM, FUEL, B(12), TOB, ASE, COLA$, TOP, BUD30, WT,
*BUD41, BUD42, BUD43, BUD45, BUD46, BUD54, BUD56, BUD57, BUD20,
*BUD01, BUDFUL, OG30, CG41, OG42, OG43, OG45, CG46, CG54, OG56,
*OG57, OG20, OG01, CFUEL, TOCOLA, I56, I57, I20, I01, I77,
*I30, I41, I42, I43, I45, I46, I54,
*NEED45, NEED46, NEED54, NEED56, NEED57, NEED20, NEED01,
*NEED77, ICDIFF, PERDIF, GOT30, GOT41, GOT42, GOT43, GOT45,
*GOT46, GOT54, GOT56, GOT57, GOT20, GOT01, GOT77

TOP-OF-FCRM
WRITE (6,90C)

OUTPUT MAIN HEADING
WRITE (6,20C)

READ (3,101) COLA
INSERT VALUES AS COMPUTED BY REGRESSION
FP=.0652
AVI=.0783
EC=.0682
CE=.0707
NE=.0756
OE=.0553
SA=.0653
PT=.1203
MED=.0512
TVLTRA=.081C
HGM=.0817
FUEL=.4C50
WRITE (6,201)

```

CCCCCCCC

CCCCC



COL0C490  
COL0C500  
COL0C510  
COL0C520  
COL0C530  
COL0C540  
COL0C550  
COL0C560  
COL0C570  
COL0C580  
COL0C590  
COL0C600  
COL0C610  
COL0C620  
COL0C630  
COL0C640  
COL0C650  
COL0C660  
COL0C670  
COL0C680  
COL0C690  
COL0C700  
COL0C710  
COL0C720  
COL0C730  
COL0C740  
COL0C750  
COL0C760  
COL0C770  
COL0C780  
COL0C790  
COL0C800  
COL0C810  
COL0C820  
COL0C830  
COL0C840  
COL0C850  
COL0C860  
COL0C870  
COL0C880  
COL0C890  
COL0C900  
COL0C910  
COL0C920  
COL0C930  
COL0C940  
COL0C950  
COL0C960

WR I TE (6,202) FP  
WR I TE (6,203) AVI  
WR I TE (6,204) EC  
WR I TE (6,205) CE  
WR I TE (6,206) NE  
WR I TE (6,207) OE  
WR I TE (6,208) SA  
WR I TE (6,209) PT  
WR I TE (6,210) MED  
WR I TE (6,211) TVLTRA  
WR I TE (6,212) HGM  
WR I TE (6,213) FUEL

C  
C  
C  
C  
C

END INDIVIDUAL GG MODELS

READ IN LAST YEARS BUDGET(THIS YEAR'S BASE) FOR EACH OG ACCOUNT

DO 12 I=1,12  
READ (4,102) B(I)

CONTINUE

READ IN TOTAL OE NCN-PAY BASE  
READ (3,103) TOBASE

12  
C  
C

WR I TE (6,909)  
WR I TE (6,216) B(1)  
WR I TE (6,217) B(2)  
WR I TE (6,218) B(3)  
WR I TE (6,219) B(4)  
WR I TE (6,220) B(5)  
WR I TE (6,221) B(6)  
WR I TE (6,222) B(7)  
WR I TE (6,223) B(8)  
WR I TE (6,224) B(9)  
WR I TE (6,225) B(10)  
WR I TE (6,226) B(11)  
WR I TE (6,227) B(12)

C  
C  
C

CALCULATE ACTUAL FUNDS NEEDED BY EACH ACCOUNT

NEED30=FP\*B(1)  
NEED41=AVI\*E(2)  
NEED42=EC\*B(3)  
NEED43=CE\*B(4)  
NEED45=NE\*B(5)  
NEED46=CE\*B(6)  
NEED54=SA\*B(7)  
NEED56=PT\*B(8)





```

NEED57=MEED*E(9)
NEED20=TVLTFAB(10)
NEED01=FCM*E(11)
NEED77=FCLEL*E(12)

CALCULATE TCTAL AMOUNT OF COLA ACTUALLY NEEDED BY THE CG

WRITE (6,247)
WRITE (6,216) NEED30
WRITE (6,217) NEED41
WRITE (6,218) NEED42
WRITE (6,219) NEED43
WRITE (6,220) NEED45
WRITE (6,221) NEED46
WRITE (6,222) NEED54
WRITE (6,223) NEED56
WRITE (6,224) NEED57
WRITE (6,225) NEED20
WRITE (6,226) NEED01
WRITE (6,227) NEED77
TONEED=NEED20+NEED41+NEED42+NEED43+NEED45+NEED46+NEED54+
*NEED56+NEED57+NEED20+NEED01+NEED77
WRITE (6,248) TCNEED

READ IN COLA AMCUNT IN DOLLARS
READ (3,104) COLAS$

THE AGGREGATE MODEL

I30=(FP)*B(1)
I41=(AVI)*B(2)
I42=(EC)*B(3)
I43=(CE)*B(4)
I45=(NE)*B(5)
I46=(OE)*B(6)
I54=(SA)*B(7)
I56=(PT)*B(8)
I57=(MEC)*B(9)
I20=(TVLTRA)*B(10)
I01=(HGM)*B(11)
I77=(FCLEL)*E(12)

CHECK FCR NEGATIVE COST OF LIVING
IF (FP.LT.0.0) I30=0.0
IF (AVI.LT.0.0) I41=0.0
IF (EC.LT.0.0) I42=0.0
IF (CE.LT.0.0) I43=0.0
IF (NE.LT.0.0) I45=0.0
IF (OE.LT.0.0) I46=0.0
IF (SA.LT.0.0) I54=0.0
IF (PT.LT.0.0) I56=0.0
IF (MEC.LT.0.0) I57=0.0
IF (TVLTRA.LT.0.0) I20=0.0
IF (HGM.LT.0.0) I01=0.0
IF (FCLEL.LT.0.0) I77=0.0

```

CC

CC CC

CC



COL01450  
COL01460  
COL01470  
COL01480  
COL01490  
COL01500  
COL01510  
COL01520  
COL01530  
COL01540  
COL01550  
COL01560  
COL01570  
COL01580  
COL01590  
COL01600  
COL01610  
COL01620  
COL01630  
COL01640  
COL01650  
COL01660  
COL01670  
COL01680  
COL01690  
COL01700  
COL01710  
COL01720  
COL01730  
COL01740  
COL01750  
COL01760  
COL01770  
COL01780  
COL01790  
COL01800  
COL01810  
COL01820  
COL01830  
COL01840  
COL01850  
COL01860  
COL01870  
COL01880  
COL01890  
COL01900  
COL01910  
COL01920

```
IF (OE.LT.0.0) I46=C.0
IF (SA.LT.0.0) I54=0.0
IF (PT.LT.0.0) I56=0.0
IF (MED.LT.C.0) I57=0.0
IF (TVLTRA.LT.0.0) I20=0.0
IF (HGM.LT.C.0) I01=0.0
IF (FUEL.LT.0.0) I77=0.0

TOP= (I20)+(I41)+(I42)+(I43)+(I45)+(I46)+(I54)+(I56)+
*(I57)+(I20)+(I01)+(I77)
```

CALCULATE THE INDIVIDUAL COLA AMOUNTS

```
WT=(TOBASE*(COLA/100.0))
BUD30= (I30/TOP)*WT
BUD41= (I41/TOP)*WT
BUD42= (I42/TOP)*WT
BUD43= (I43/TOP)*WT
BUD45= (I45/TOP)*WT
BUD46= (I46/TOP)*WT
BUD54= (I54/TOP)*WT
BUD56= (I56/TOP)*WT
BUD57= (I57/TOP)*WT
BUD20= (I20/TOP)*WT
BUD01= (I01/TOP)*WT
BUDFUL= (I77/TOP)*WT
DETERMINE COLA AMOUNTS
```

```
OG30= BUC30
OG41= BUC41
OG42= BUC42
OG43= BUC43
OG45= BUC45
OG46= BUC46
OG54= BUC54
OG56= BUC56
OG57= BUC57
OG20= BUC20
OG01= BUC01
OFUEL= BUDFUL
```

```
WR ITE (6,90C)
WR ITE (6,231) OG30
WR ITE (6,216) OG41
WR ITE (6,217) OG42
WR ITE (6,218) OG43
WR ITE (6,219) OG45
```



COL01930  
COL01940  
COL01950  
COL01960  
COL01970  
COL01980  
COL01990  
COL02000  
COL02010  
COL02020  
COL02030  
COL02040  
COL02050  
COL02060  
COL02070  
COL02080  
COL02090  
COL02100  
COL02110  
COL02120  
COL02130  
COL02140  
COL02150  
COL02160  
COL02170  
COL02180  
COL02190  
COL02200  
COL02210  
COL02220  
COL02230  
COL02240  
COL02250  
COL02260  
COL02270  
COL02280  
COL02290  
COL02300  
COL02310  
COL02320  
COL02330  
COL02340  
COL02350  
COL02360  
COL02370  
COL02380  
COL02390  
COL02400

WRITTE (6,221) OG46  
WRITTE (6,222) OG54  
WRITTE (6,223) OG56  
WRITTE (6,224) OG57  
WRITTE (6,225) OG20  
WRITTE (6,226) OG01  
WRITTE (6,227) OFUEL  
TOTAL CCLA RECEIVED AS COMPUTED BY PROGRAM  
TOCOLA = CG3C+OG41+OG42+OG43+OG45+OG46+OG54+OG56+UG57+UG20  
\*+OG01+CFUEL  
WRITTE (6,224) TCCOLA  
DIFFERENCE BETWEEN COLA  
TODIFF=TCNEED-CCLA\$  
WRITTE (6,249) TODIFF  
PERCENT CIFA\$ / TONEED  
PERDIF (6,250) PERDIF  
PERFORM A CHECK  
DIFFERENCE BETWEEN COLA RECEIVED AND COLA CALCULATED  
DICOLA = COLA\$ - TCCOLA  
WRITTE (6,245) DICOLA  
GOT30 = CG30 / NEED30  
GOT41 = CG41 / NEED41  
GOT42 = CG42 / NEED42  
GOT43 = CG43 / NEED43  
GOT45 = CG45 / NEED45  
GOT46 = CG46 / NEED46  
GOT54 = CG54 / NEED54  
GOT56 = CG56 / NEED56  
GOT57 = CG57 / NEED57  
GOT20 = CG20 / NEED20  
GOT01 = CG01 / NEED01  
GOT77 = CFUEL / NEED77  
WRITTE (6,263) GOT30  
WRITTE (6,251) GOT41  
WRITTE (6,252) GOT42  
WRITTE (6,253) GOT43  
WRITTE (6,254) GOT45  
WRITTE (6,255) GOT46  
WRITTE (6,256) GOT54  
WRITTE (6,257) GOT56  
WRITTE (6,258) GOT57  
WRITTE (6,259) GOT20  
WRITTE (6,260) GOT01  
WRITTE (6,261) GOT77  
C EJECT PAGE









254  
255  
256  
257  
258  
259  
260  
261  
262  
263

FORMAT (.0. .0G-43. .2X,F8.6)  
FORMAT (.0. .0G-45. .2X,F8.6)  
FORMAT (.0. .0G-46. .2X,F8.6)  
FORMAT (.0. .0G-54. .2X,F8.6)  
FORMAT (.0. .0G-56. .2X,F8.6)  
FORMAT (.0. .0G-57. .2X,F8.6)  
FORMAT (.0. .0G-20. .2X,F8.6)  
FORMAT (.0. .0G-01. .2X,F8.6)  
FORMAT (.0. .FUEL. .2X,F8.6)  
FORMAT (.0. .PER CENT OF ACTUAL FUNDS NEEDED RECEIVED BY  
\*EACH ACCOUNT.)  
END

COL02890  
COL02900  
COL02910  
COL02920  
COL02930  
COL02940  
COL02950  
COL02960  
COL02970  
COL02980  
COL02990  
COL03000



FIGURE B--7

LIST OF VARIABLES USED IN PROGRAMS

I  
Z(I)

INDEX FOR DO LOOPS  
VALUES OF INDEXES, PERCENT OR INDEX  
INDIVIDUAL MODEL REPRESENTATIONS

FP  
AVI  
EC  
CE  
NE  
OE  
SA  
PT  
MED  
TVL TRA  
HGM  
FUEL

OG30  
OG41  
OG42  
OG43  
OG45  
OG46  
OG54  
OG56  
OG57  
OG20  
OG01  
FUEL

ACCOUNT

AFM  
AFL  
EM  
EL  
ELM  
ELL  
TVL  
AIRFRAME MATERIALS  
AIRFRAME LABCR  
ENGINE MATERIALS  
ENGINE LABOR  
ELECTRICAL MATERIALS  
ELECTRICAL LABOR  
TRAVEL

INDIVIDUAL MODEL VARIABLES FOR PROGRAMS 2 AND 3

FP1  
FP2  
A1  
A2  
EC1  
EC2  
CE1  
CE2  
NE1  
NE2  
OE1  
OE2  
SA  
PT  
MED1  
MED2

OG30 MATERIAL  
OG30 LABCR  
OG41 MATERIAL  
OG41 LABOR  
OG42 MATERIAL  
OG42 LABOR  
OG43 MATERIAL  
OG43 LABCR  
OG45 MATERIAL  
OG45 LABCR  
OG46 MATERIAL  
OG46 LABOR  
OG54  
OG56  
OG57 MATERIAL  
OG57 LABCR



PS1  
 PS2  
 AF1  
 AF2  
 TRANS1  
 TVL1  
 TVL2  
 TFM  
 TFL  
 RF  
 PSM  
 PSLNM  
 TRANL  
 TVL1M  
 TVL2M  
 B(1)  
 TOBASE  
 TOBASE  
 TOBASE  
 COLA\$  
 TOP  
 WT  
 BUD(1),GG(1)  
 TOCOLA  
 GOT(1)  
 TODIFF  
 PERDIFF

POSTAL SERVICE MATERIAL  
 POSTAL SERVICE LABOR  
 AIRFRAME MATERIAL  
 AIRFRAME LABOR  
 TRANSPORTATION MATERIAL  
 TRANSPORTATION LABOR  
 QG20 MATERIAL  
 QG20 LABOR  
 TRUCK FREIGHT MATERIAL  
 TRUCK FREIGHT LABOR  
 RAIL FREIGHT  
 POSTAL SERVICE MATERIAL  
 POSTAL SERVICE LABOR  
 TRANSPORTATION MATERIAL  
 TRANSPORTATION LABOR  
 TRAVEL AND TRANSPORTATION MATERIAL  
 BASE AMOUNT FOR EACH ACCOUNT  
 TOTAL NON-PAY OF BASE  
 ACTUAL FUNDS NEEDED BY EACH ACCOUNT  
 ACTUAL COLA FUNDS ACTUALLY NEEDED BY THE COAST GUARD  
 COLA AMOUNT RECEIVED BY THE COAST GUARD IN DOLLARS  
 CALCULATION FOR ALLOCATION MODEL  
 CALCULATION FOR ALLOCATION MODEL  
 REPRESENT THE COLA AMOUNT RECEIVED BY EACH ACCOUNT  
 TOTAL COLA RECEIVED AS CALCULATED BY PROGRAM  
 PERCENT OF ACTUAL FUNDS NEEDED THAT WERE RECEIVED  
 DOLLAR DIFFERENCE BETWEEN COLA RECEIVED AND COLA NEEDED  
 PERCENT DIFFERENCE



FIGURE B-8

ALLCCATION OF COLA FUNDS FOR FY 1982

COST OF LIVING			
OG-30	0.069200		
OG-41	0.078300		
OG-42	0.068200		
OG-43	0.070700		
OG-45	0.075600		
OG-46	0.059800		
OG-54	0.065200		
OG-56	0.120300		
OG-57	0.051200		
OG-20	0.081000		
OG-C1	0.081700		
FUEL	0.409000		
BASE FOR INDIVIDUAL OG ACCOUNTS			
OG-30	310469000.00		
OG-41	453350000.00		
OG-42	556790000.00		
OG-43	387330000.00		
OG-45	490221000.00		
OG-46	568300000.00		
OG-54	302260000.00		
OG-56	1452250000.00		
OG-57	847130000.00		
OG-20	2422080000.00		
OG-01	544800000.00		
FUEL	405450000.00		
ACTUAL FUNDS NEEDED FOR INFLATION			
OG-30	21484448.37		
OG-41	31554036.97		
OG-42	3757307.36		
OG-43	27138422.70		
OG-45	3705558.97		
OG-46	579043.35		
OG-54	157255.11		
OG-56	1747357.43		
OG-57	433817.55		
OG-20	1960847.28		
OG-C1	445101.75		
FUEL	16584540.17		
TOTAL	ACTUAL FUNDS NEEDED	57228192.00	
COLA AMOUNTS FOR EACH OG ACCOUNT			
OG-30	17721907.27		
OG-41	2931623.45		





OG-42	3132250.25				
OG-43	228846.60				
OG-45	3056964.36				
OG-46	477636.34				
OG-54	162743.10				
OG-56	1441345.15				
OG-57	357843.73				
OG-20	1617446.87				
OG-01	367151.71				
FUEL	13680113.07				
TOTAL COLA ALLOCATED		47205912.00			
DIFFERENCE BETWEEN COLA NEEDED AND COLA					
PER CENT DIFFERENCE		0.824872			
MONEY LEFT TO ALLOCATE					
PER CENT OF ACTUAL FUNDS NEEDED RECEIVED BY					
OG-30	0.824871				
OG-41	0.824871				
OG-42	0.824871				
OG-43	0.824871				
OG-45	0.824871				
OG-46	0.824871				
OG-54	0.824871				
OG-56	0.824871				
OG-57	0.824871				
OG-20	0.824871				
OG-01	0.824871				
FUEL	0.824871				
		RECEIVED	10022280.00		
		EACH ACCOUNT			



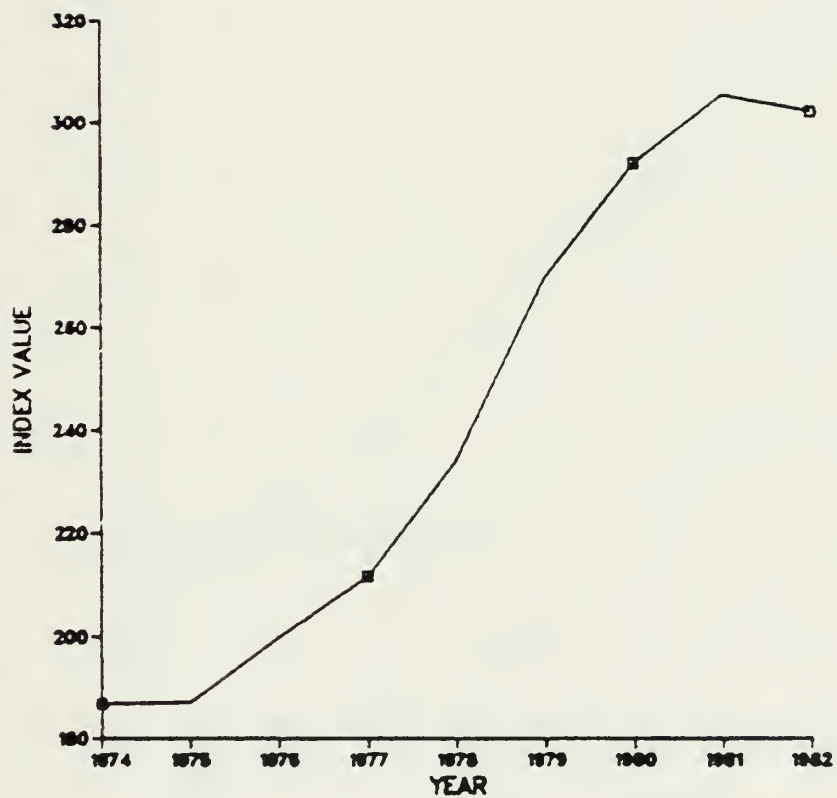
## APPENDIX C

The enclosed graphs show the trends for the various indexes that were used as proxy variables in developing the different market baskets. The graphs are developed for each account, and where appropriate, there are separate graphs for labor and materials.

If proposed weights are to be changed, the graphs can be used to estimate the effect on the final index value from these changes. If the curves are moving in similar directions and rates, the changes will have minor effects on the final index value. But if the curves are proceeding in inverse directions and/or at different rates, any change in weights could have an effect on the final value.



FIGURE C-1 OG30 MATERIALS



LEGEND  
□ = CPI-MINUS FOOD



FIGURE C-2 AIR FRAME MATERIAL

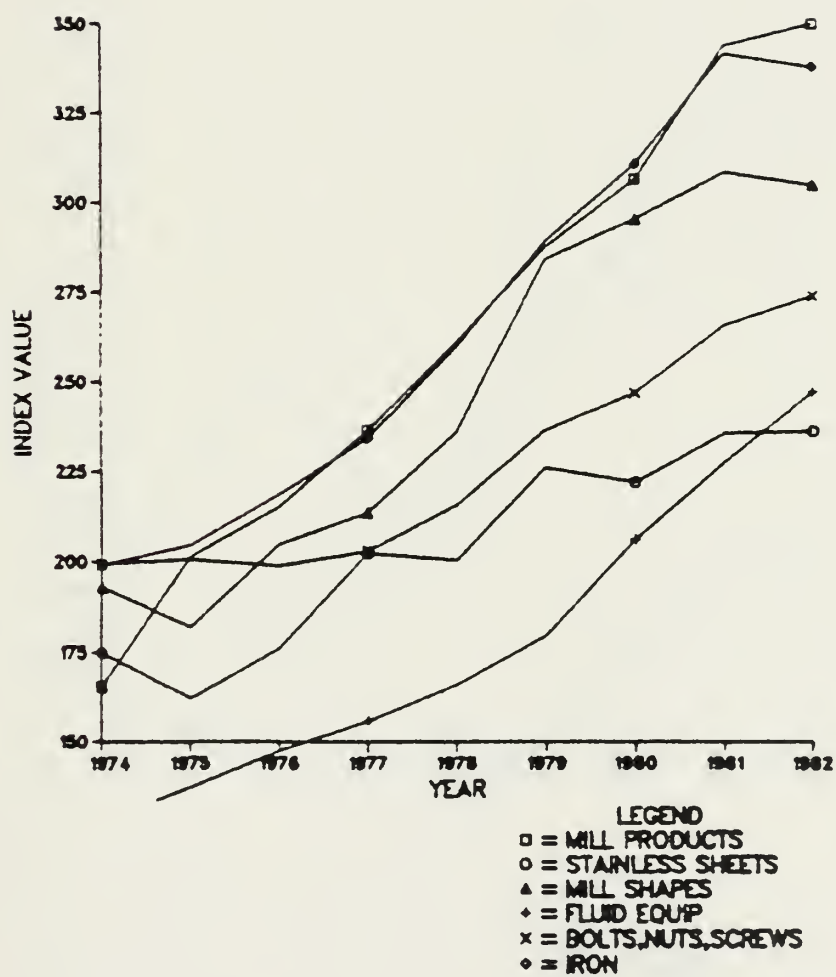






FIGURE C-3 OG-41 ENGINE MATERIAL

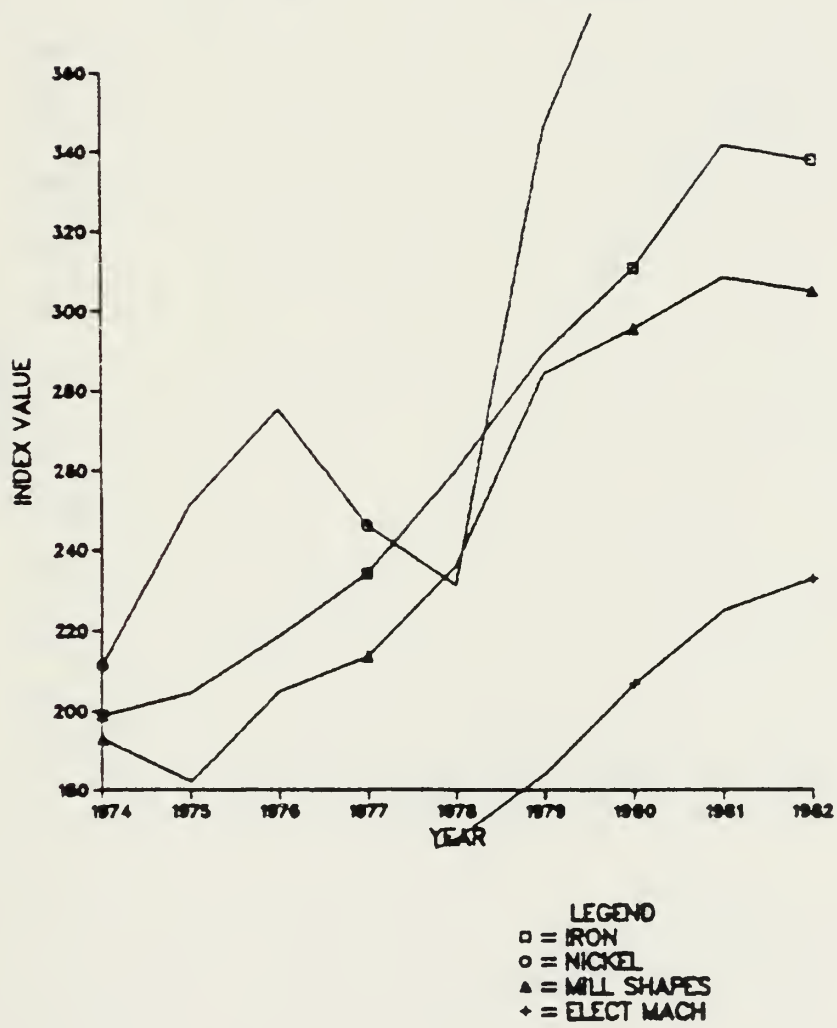
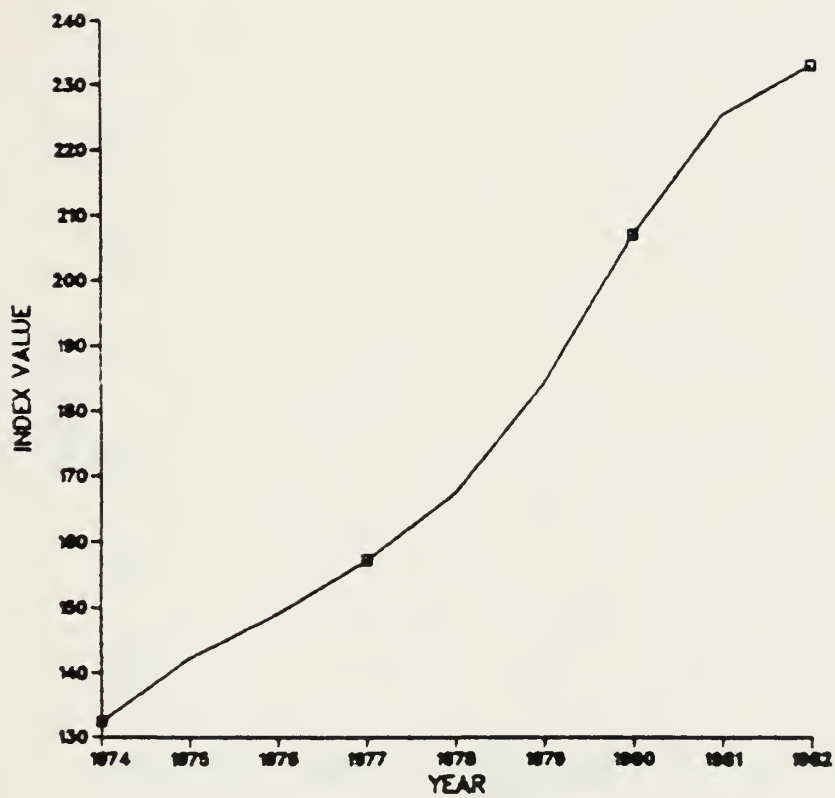




FIGURE C-4 OG41 ELECTRICAL MATERIAL



LEGEND  
□ = ELECT MACH



FIGURE C-5 OG42 MATERIAL

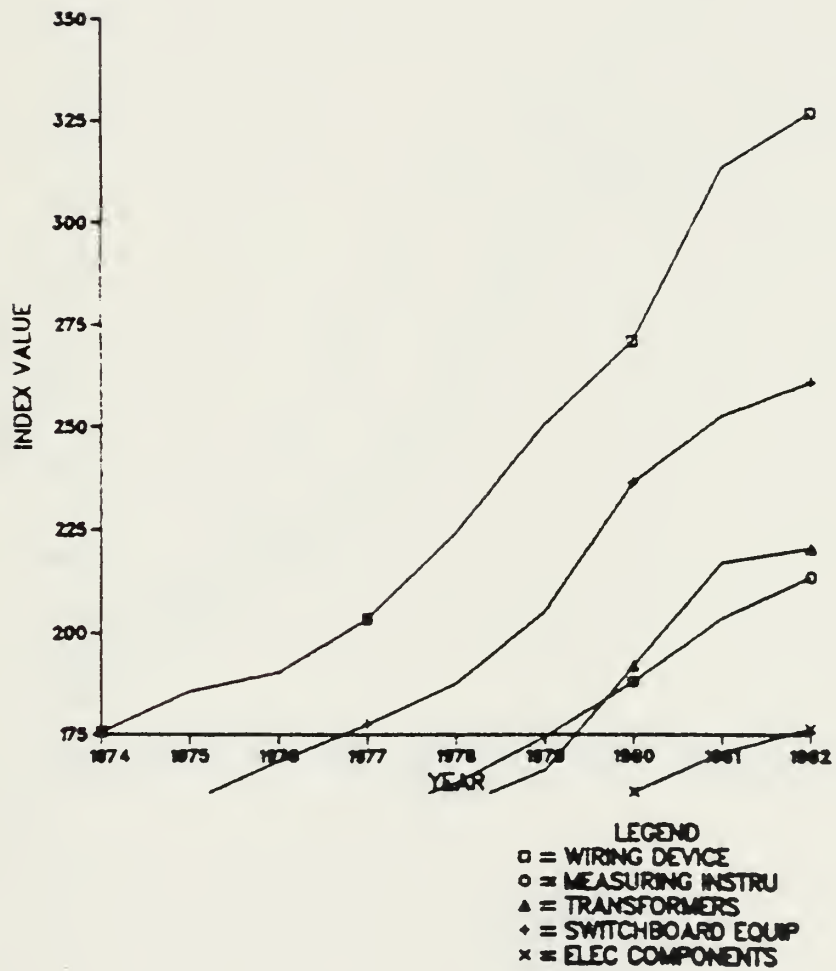




FIGURE C-6 OG43 MATERIAL

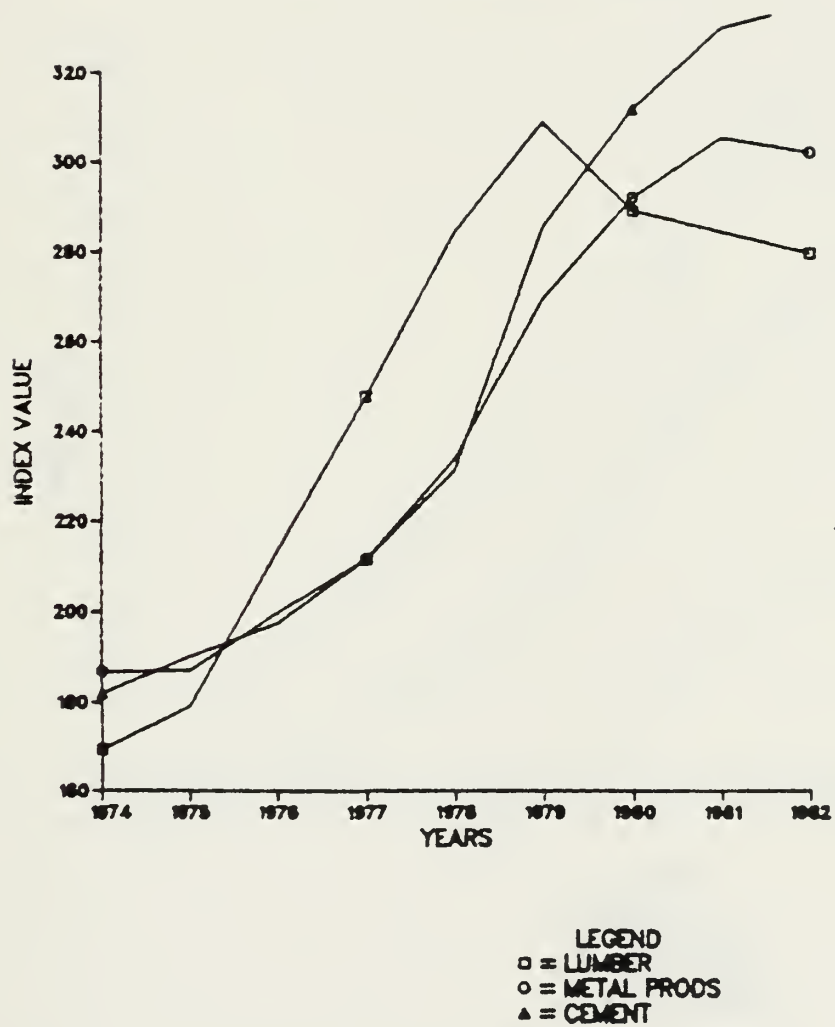






FIGURE C-7 OG45 MATERIAL

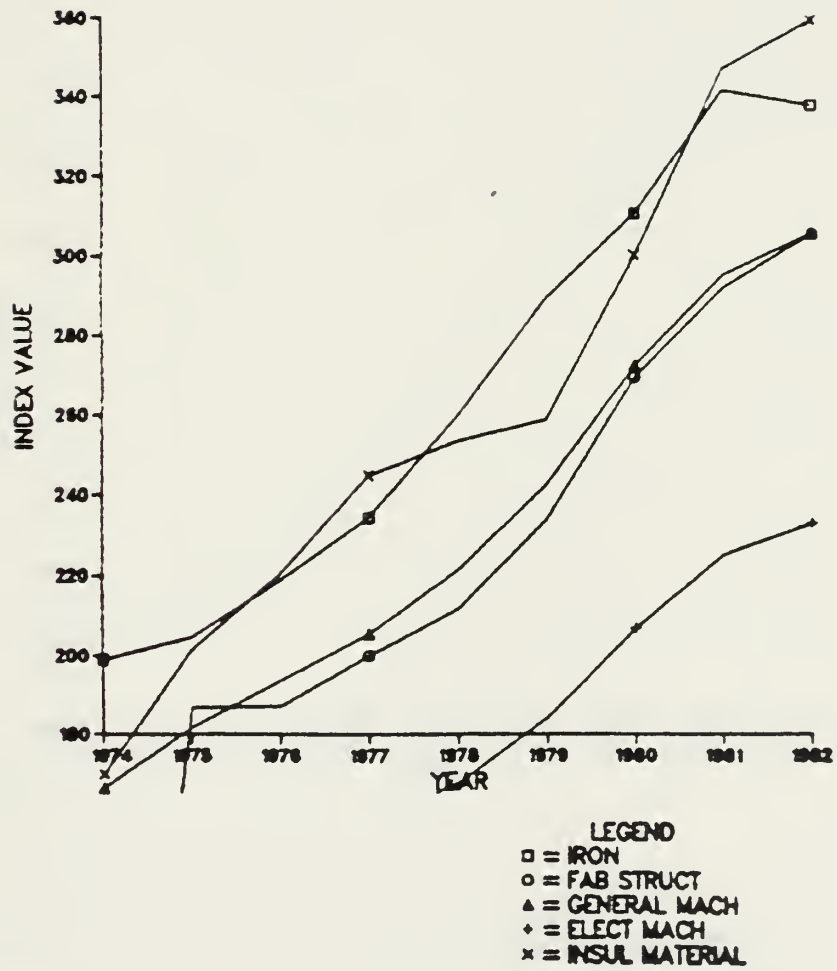




FIGURE C-8 OG48 MATERIAL

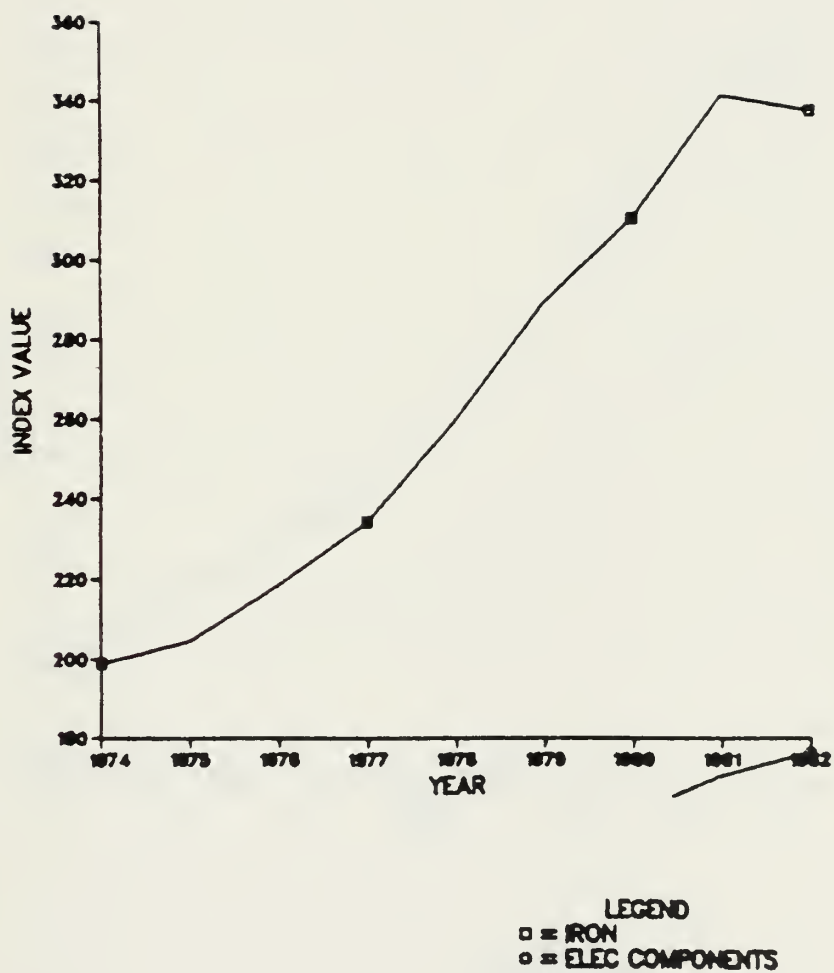




FIGURE C-9 OGS4 MATERIAL

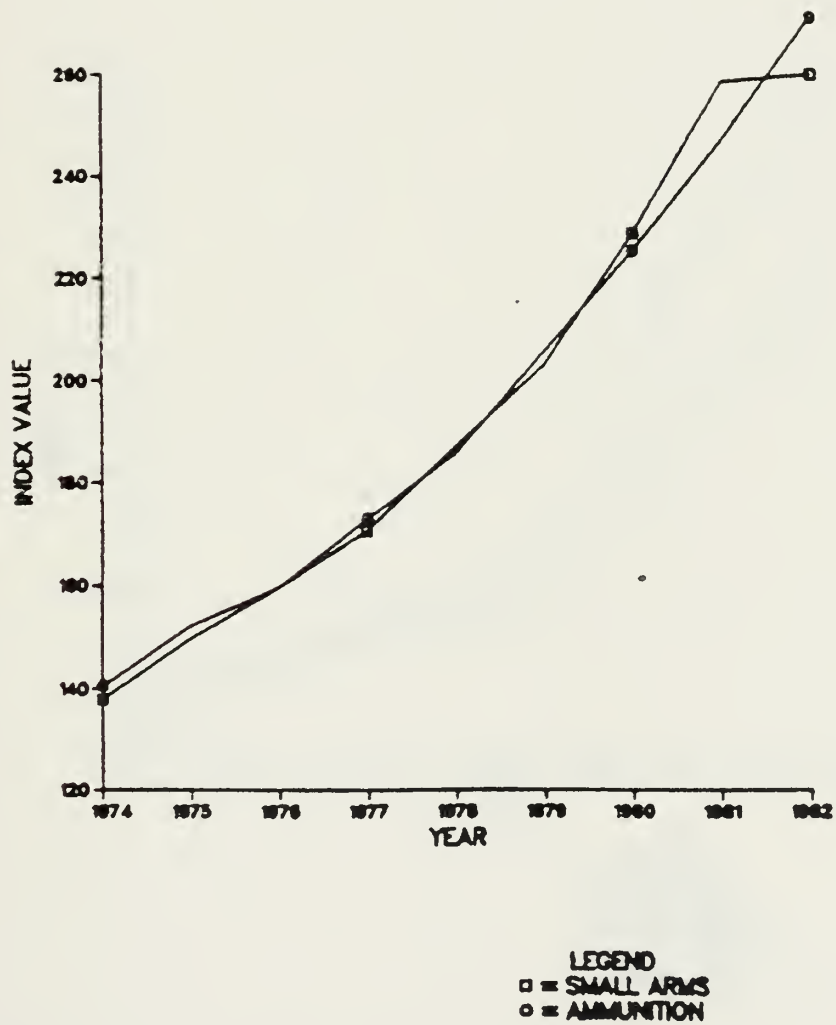




FIGURE C-10 OGS6 TRAVEL

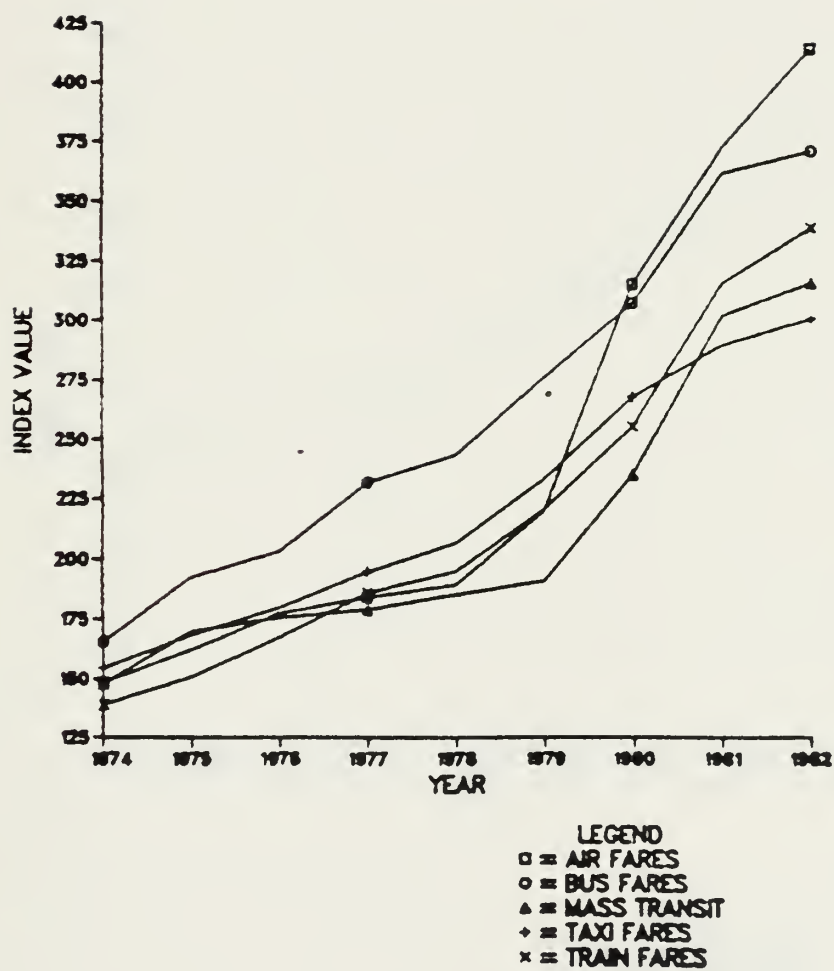
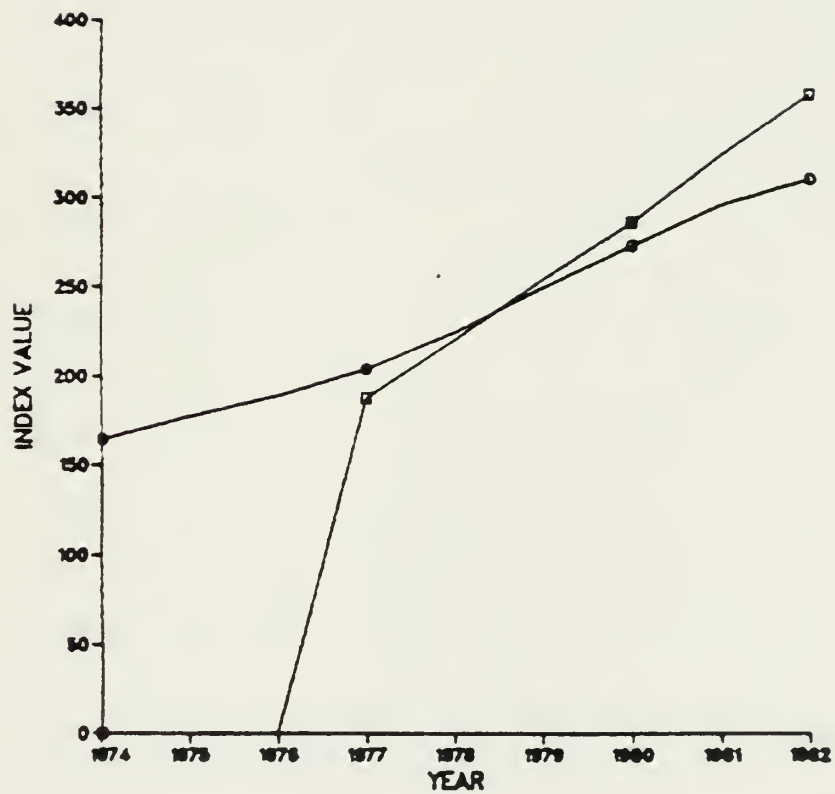






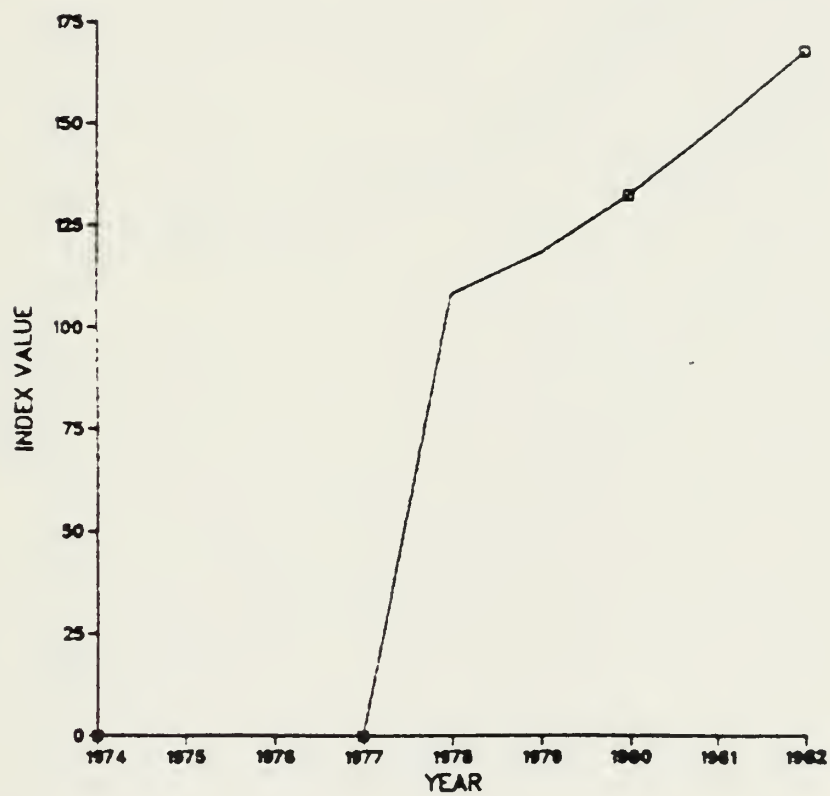
FIGURE C-11 OGS6 PER DIEM



LEGEND  
□ = LODGING OUT TOWN  
○ = FOOD AWAY HOME



FIGURE C-12 OG56 TUITION



LEGEND  
□ = TUITION FEES



FIGURE C-13 OG57 MATERIAL

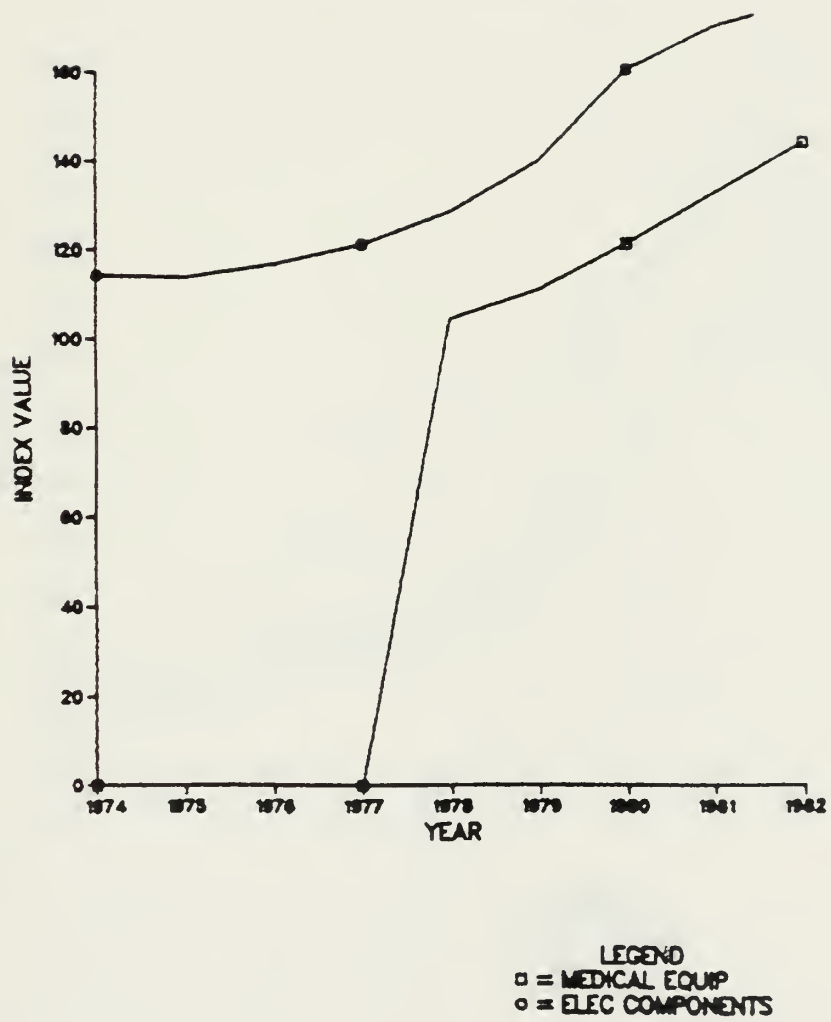




FIGURE C-14 OG20 TRAVEL

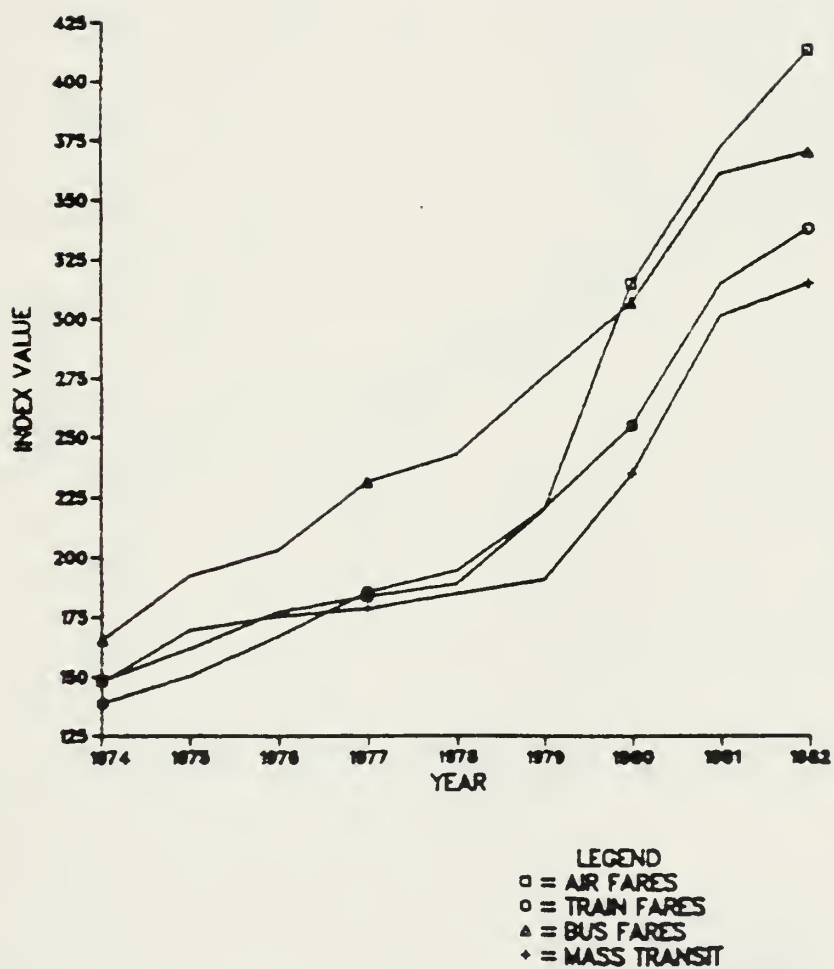






FIGURE C-15 OG20 PER DIEM

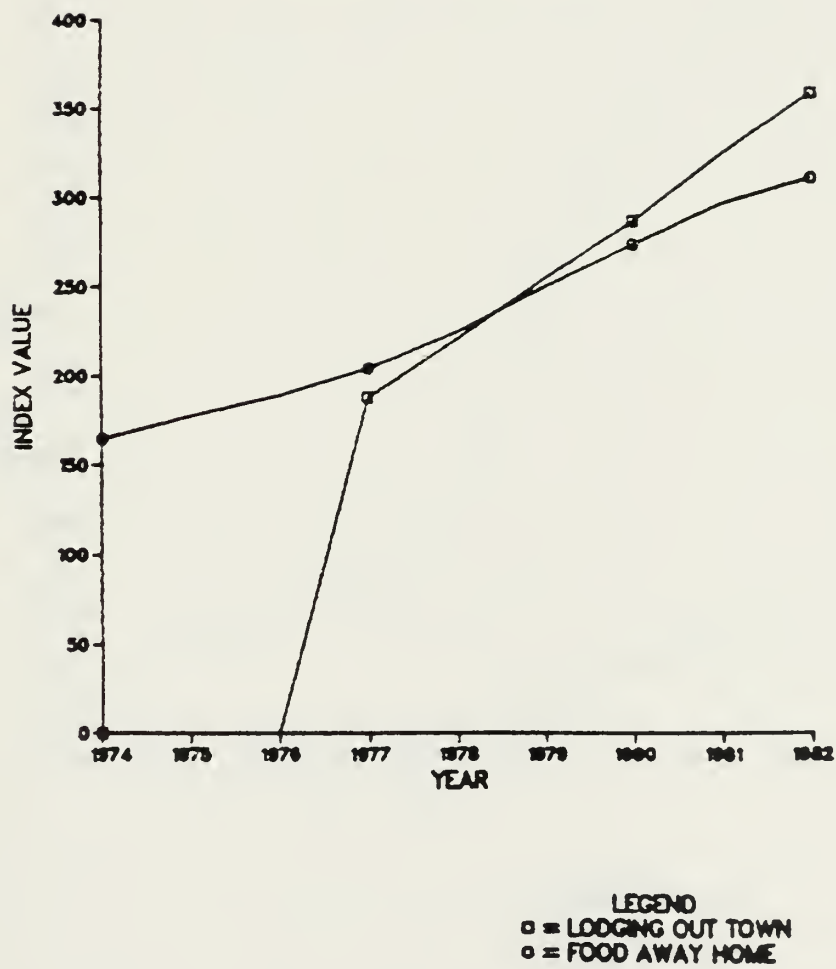




FIGURE C-16 OG20 TRUCK FREIGHT MATERIAL

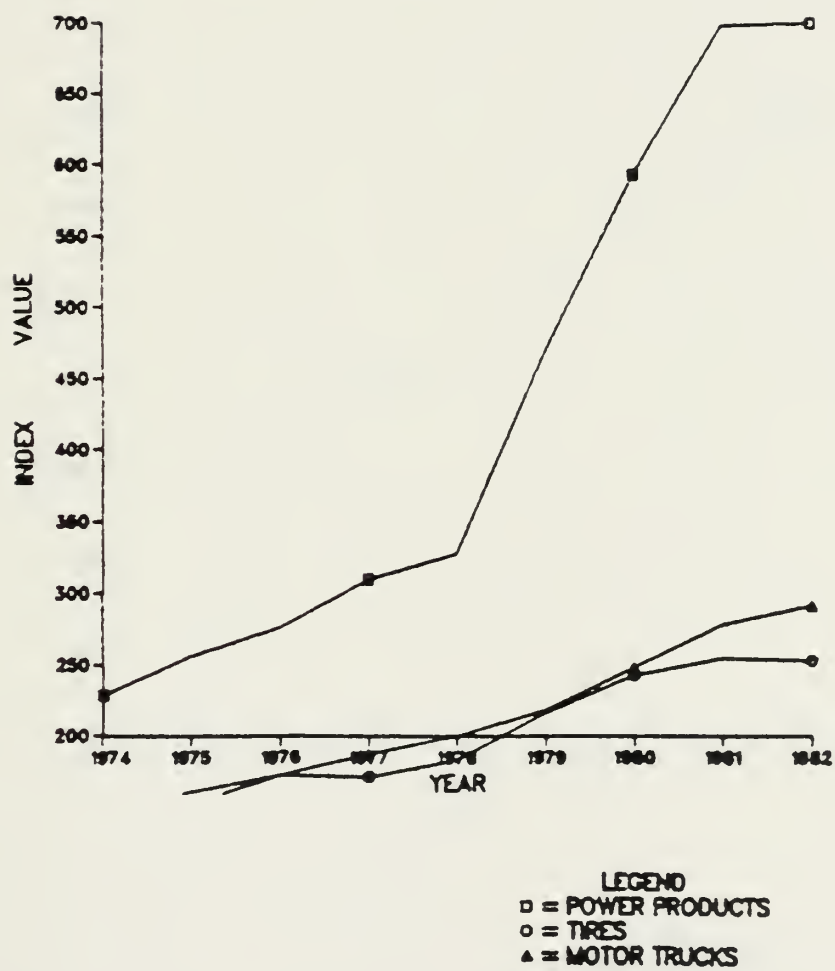
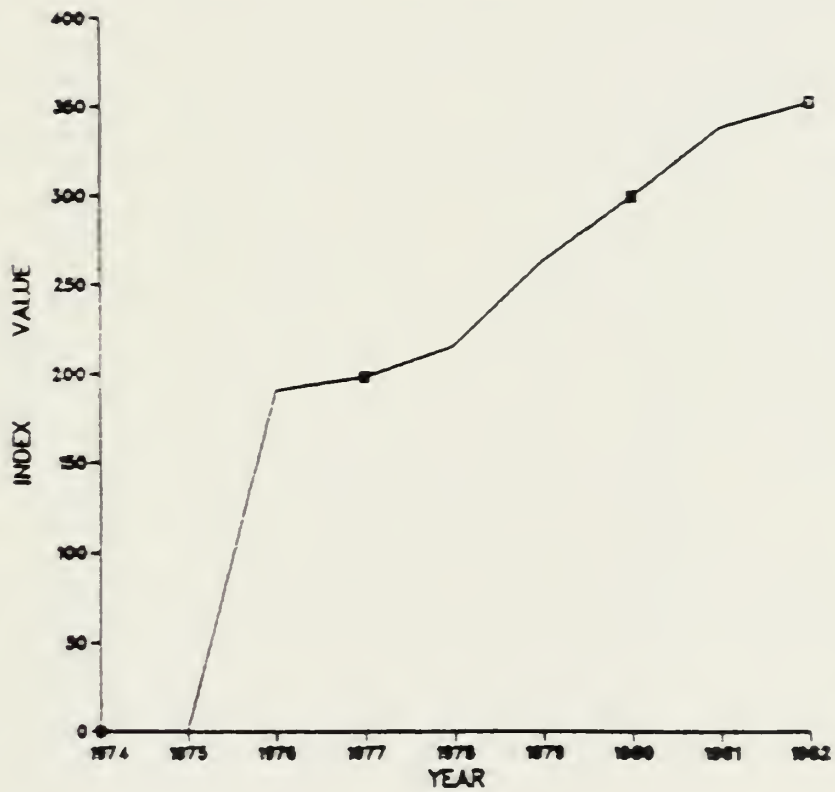




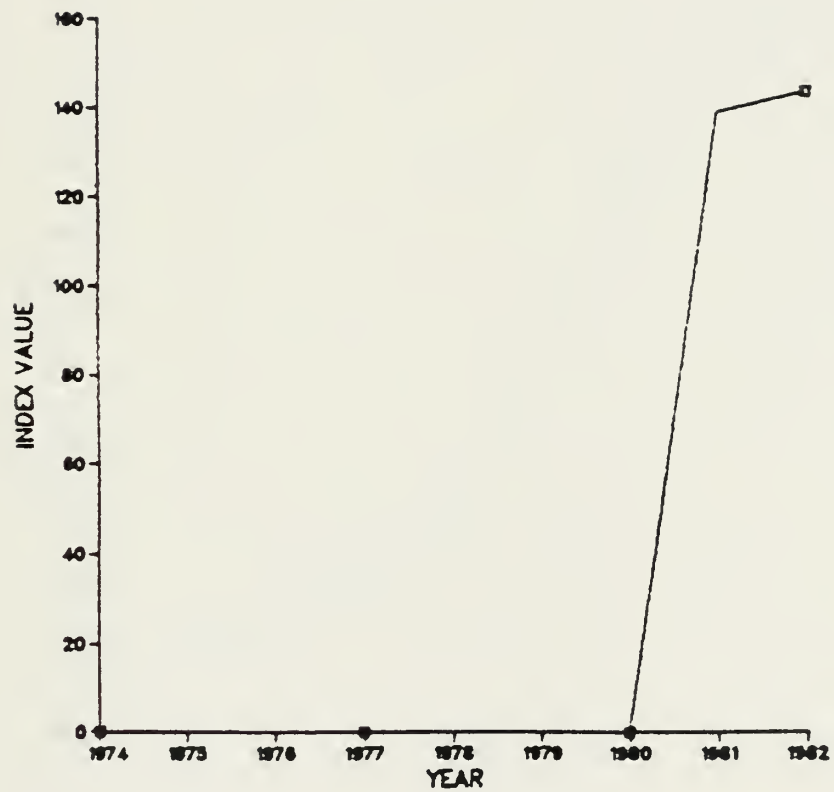
FIGURE C-17 OG20 RAIL FREIGHT MATERIAL



LEGEND  
□ = RAILROAD FREIGHT



FIGURE C-18 OG20 POSTAL FREIGHT

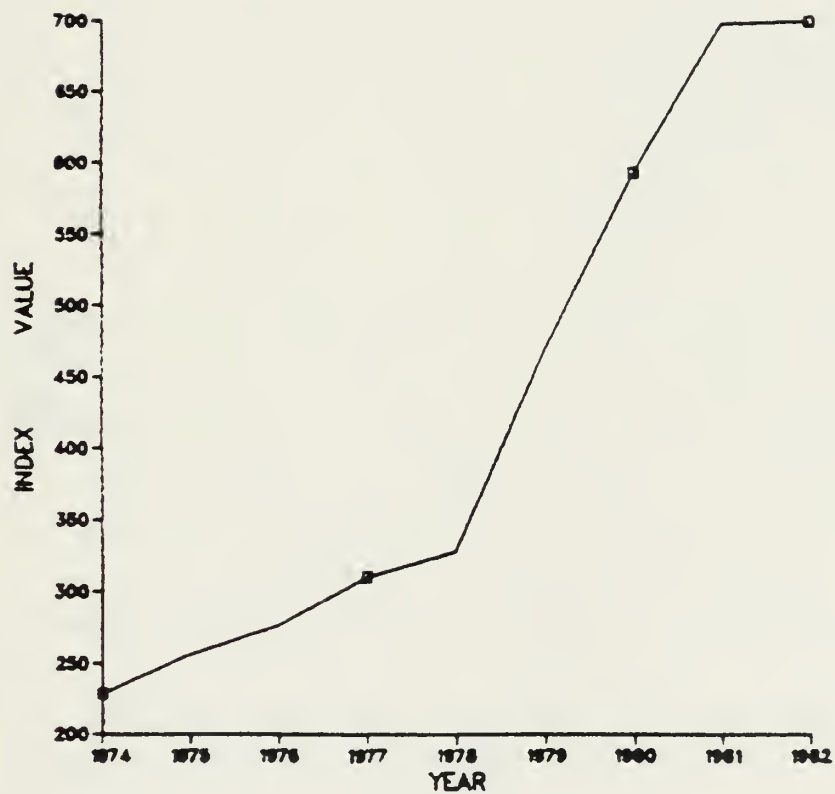


LEGEND  
□ = POSTAL SERVICE





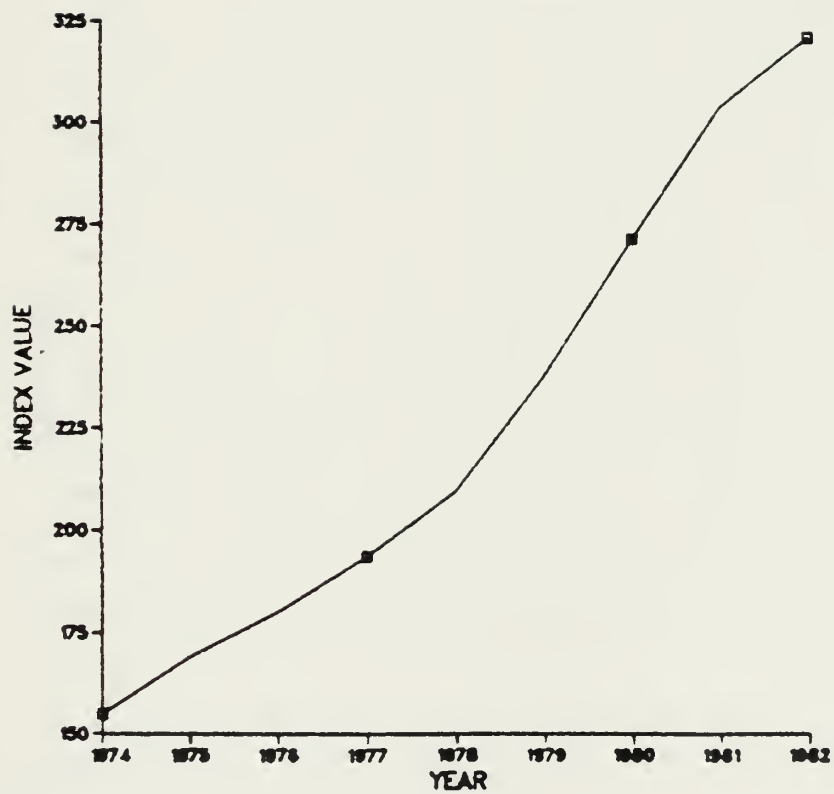
FIGURE C-19 OG20 AIR FREIGHT MATERIAL



LEGEND  
□ = POWER PRODUCTS



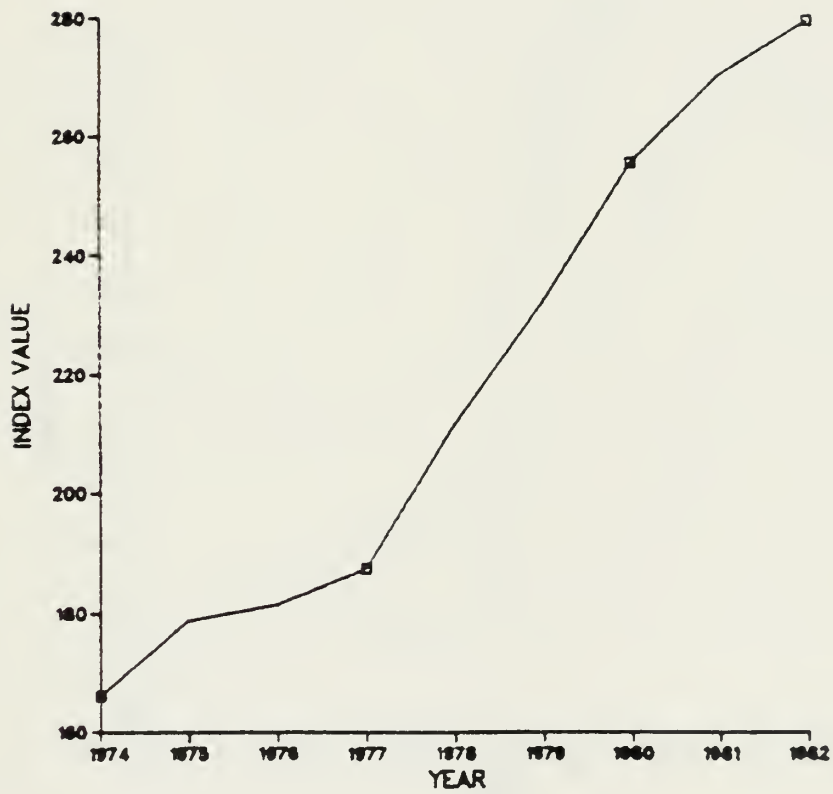
FIGURE C-20 OGO1 HOUSING



LEGEND  
□ = HOUSING



FIGURE C-21 OGO1 GENERAL MESS



LEGEND  
□ = FOOD AND BEVERAGE



FIGURE C-22 FUEL ACCOUNT

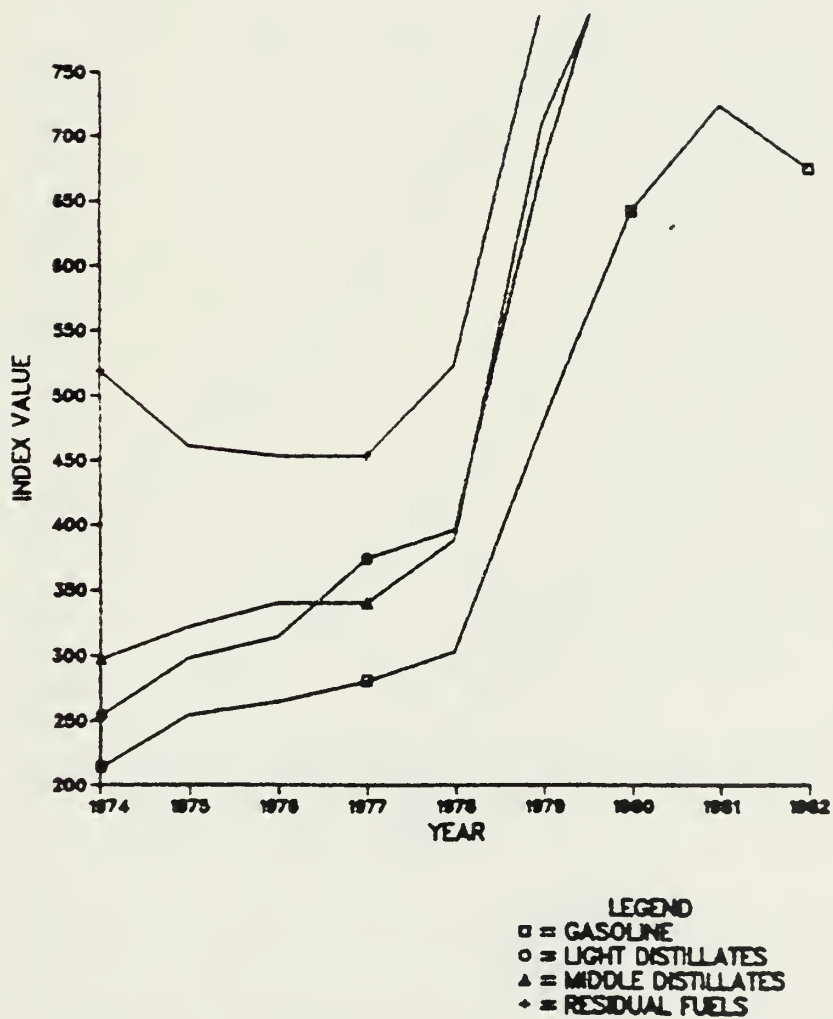






FIGURE C-23 OG30 LABOR

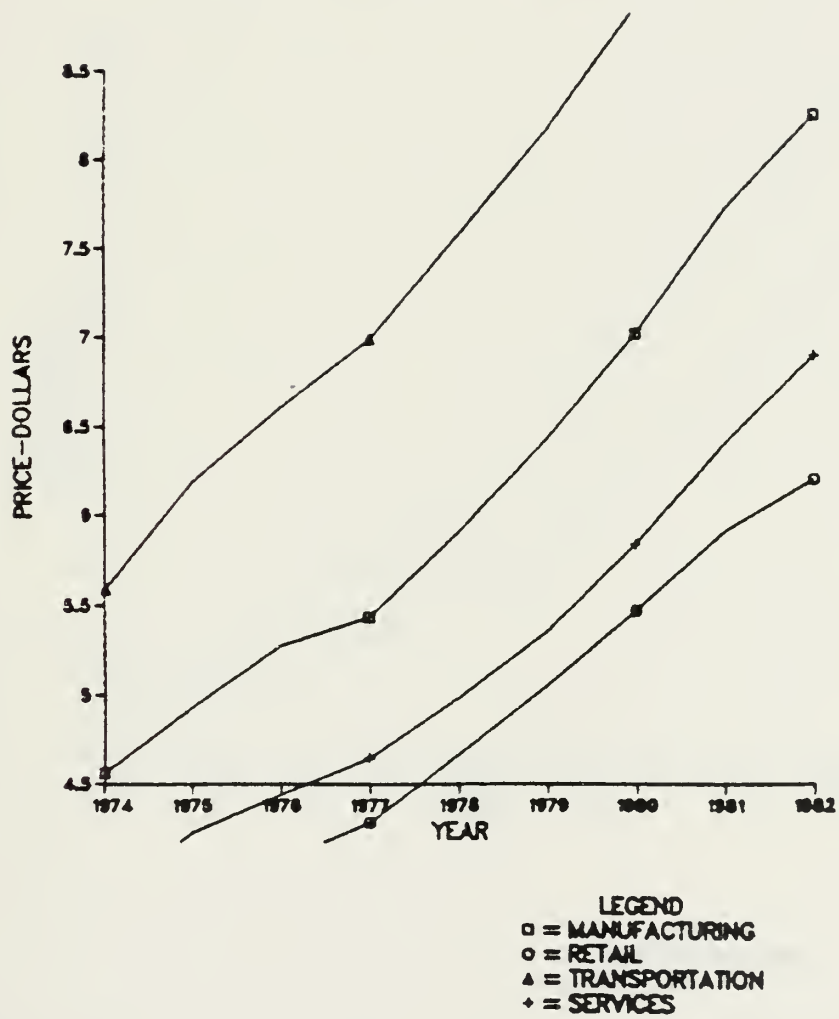
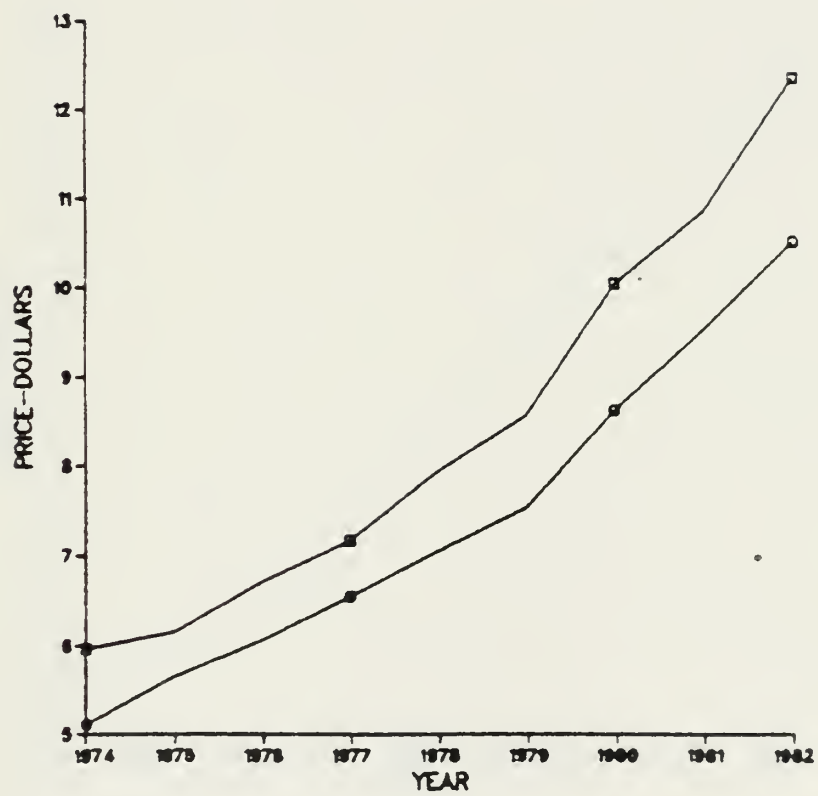




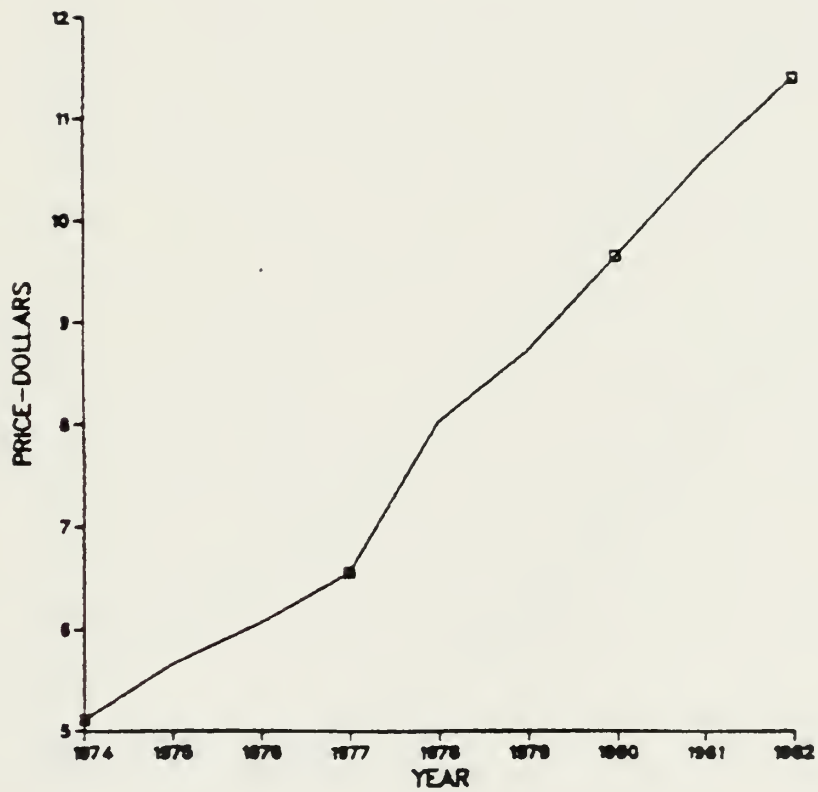
FIGURE C-24 AIRFRAME LABOR



LEGEND  
□ = AIRCRAFT INDUSTRY  
○ = A/C EQUIP



FIGURE C-25 OG41 ENGINE LABOR



LEGEND  
□ = A/C PARTS



FIGURE C-26 OG41 ELECTRICAL LABOR

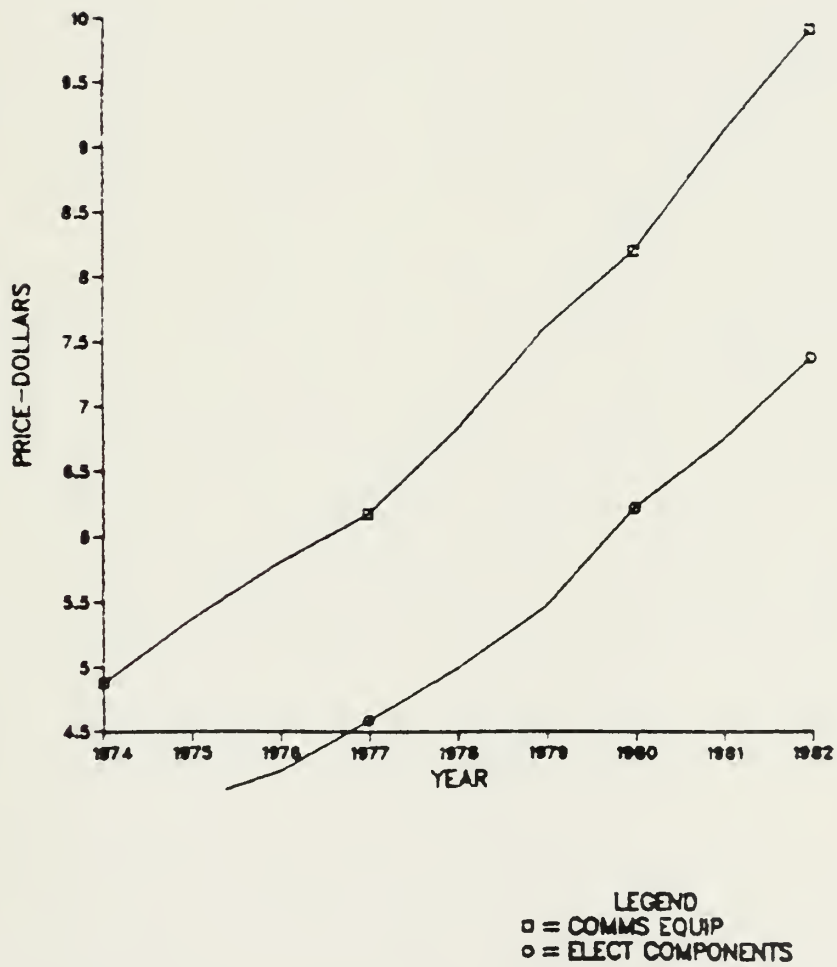
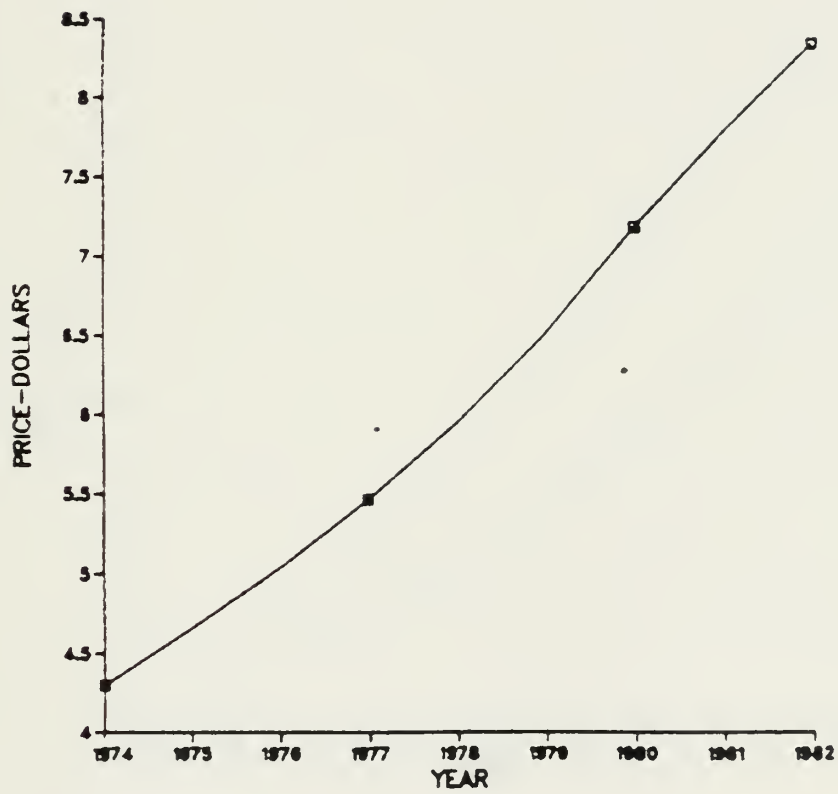






FIGURE C-27 OG42 LABOR



LEGEND  
□ = ELECT EQUIP



FIGURE C-28 OG43 LABOR

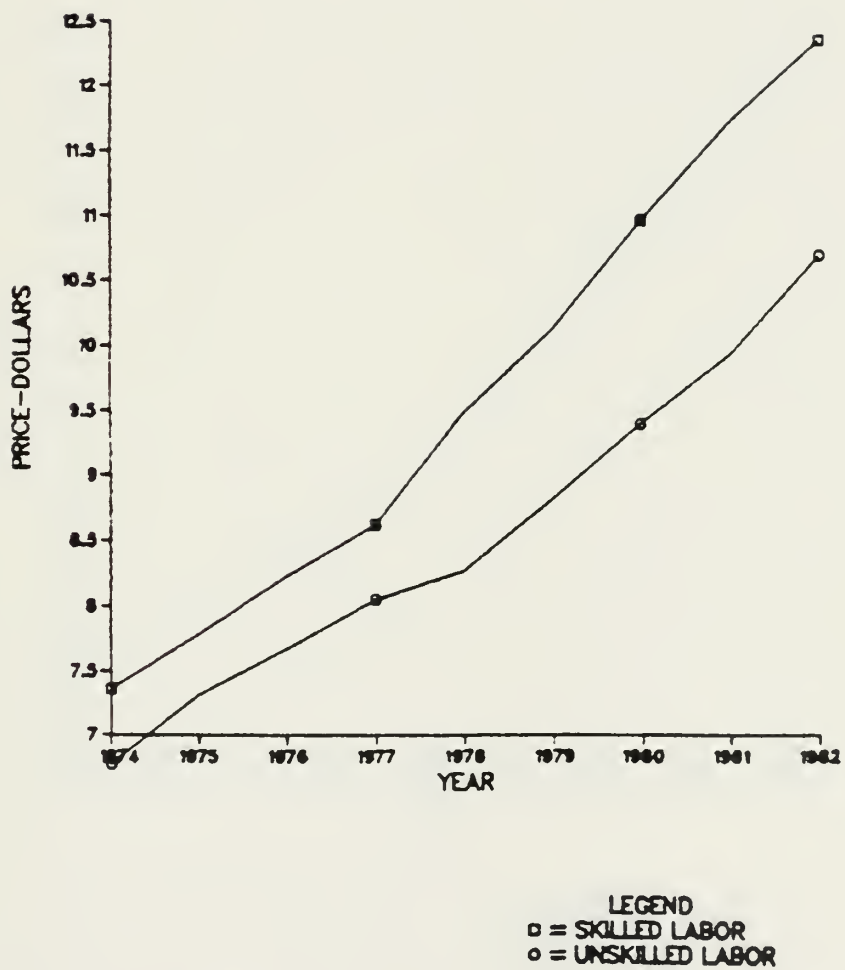




FIGURE C-29 OG45 LABOR

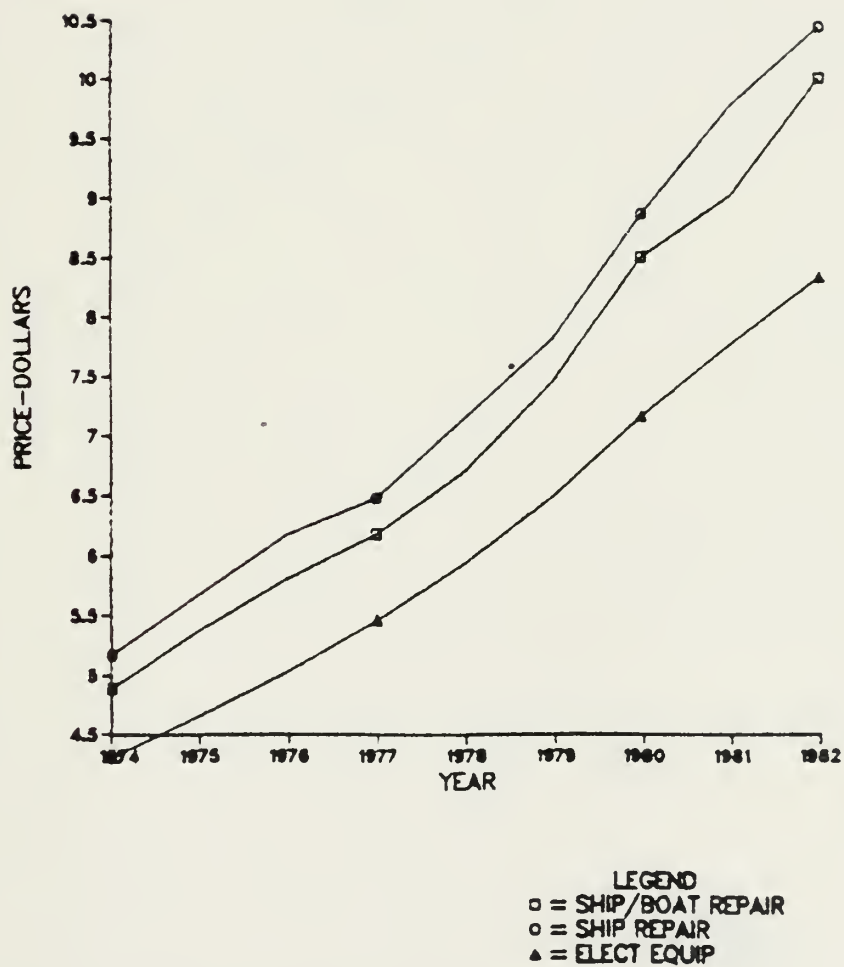




FIGURE C-30 OG46 LABOR

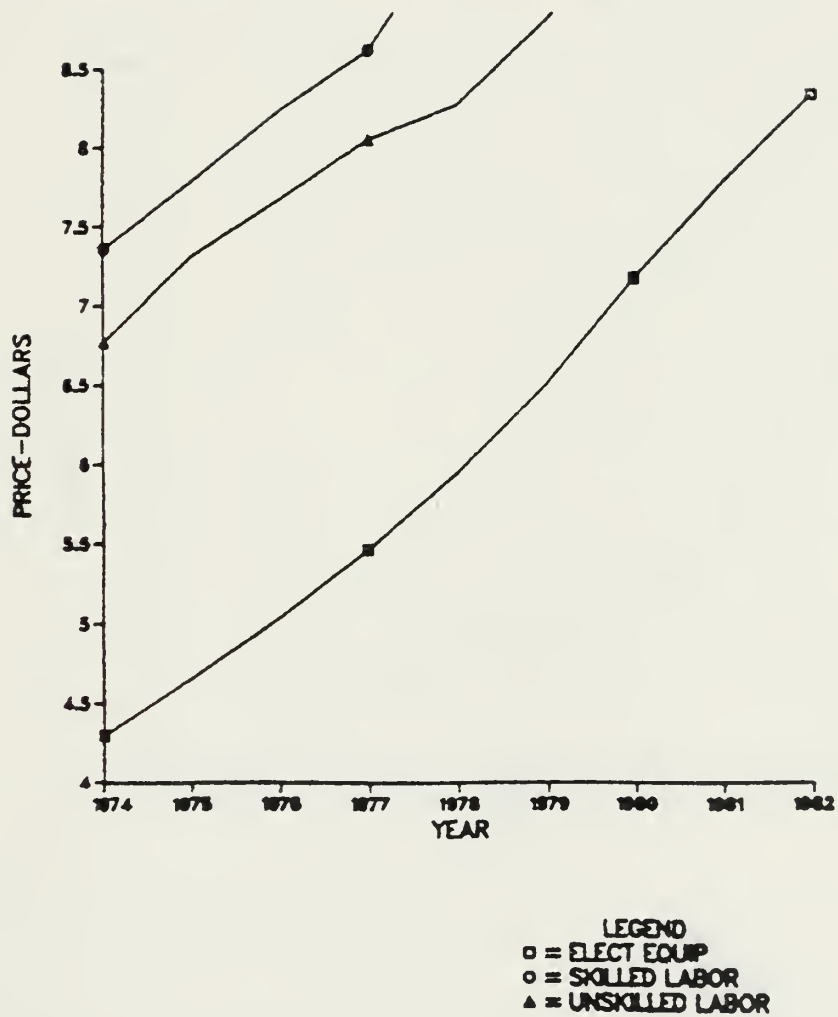
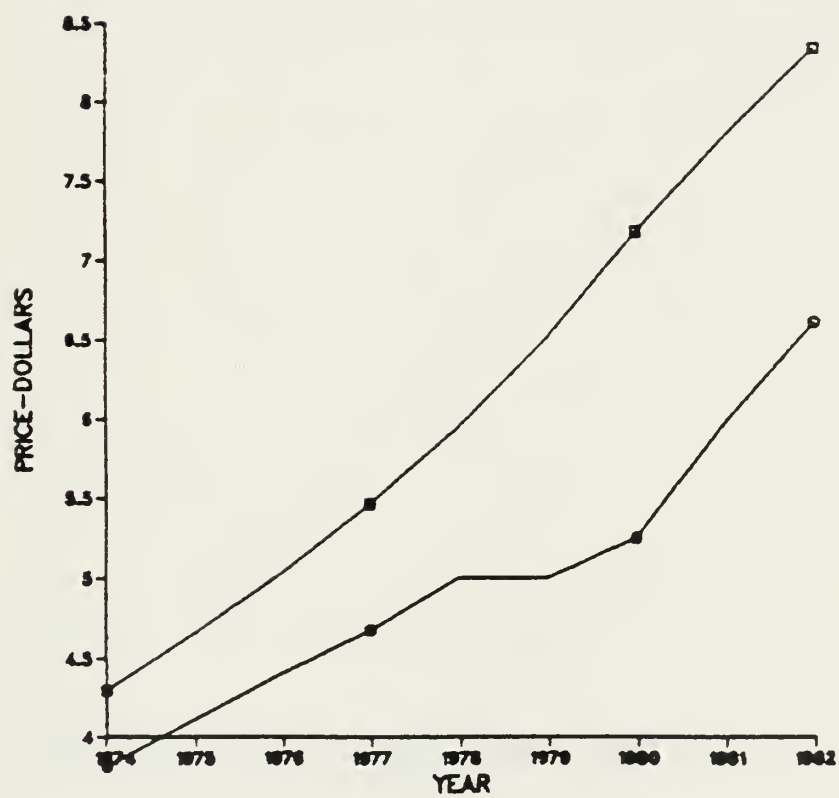






FIGURE C-31 OG57 LABOR



LEGEND  
□ = ELECT EQUIP  
○ = MEDICAL INSTRU



FIGURE C-32 OG20 TRUCK FREIGHT LABOR

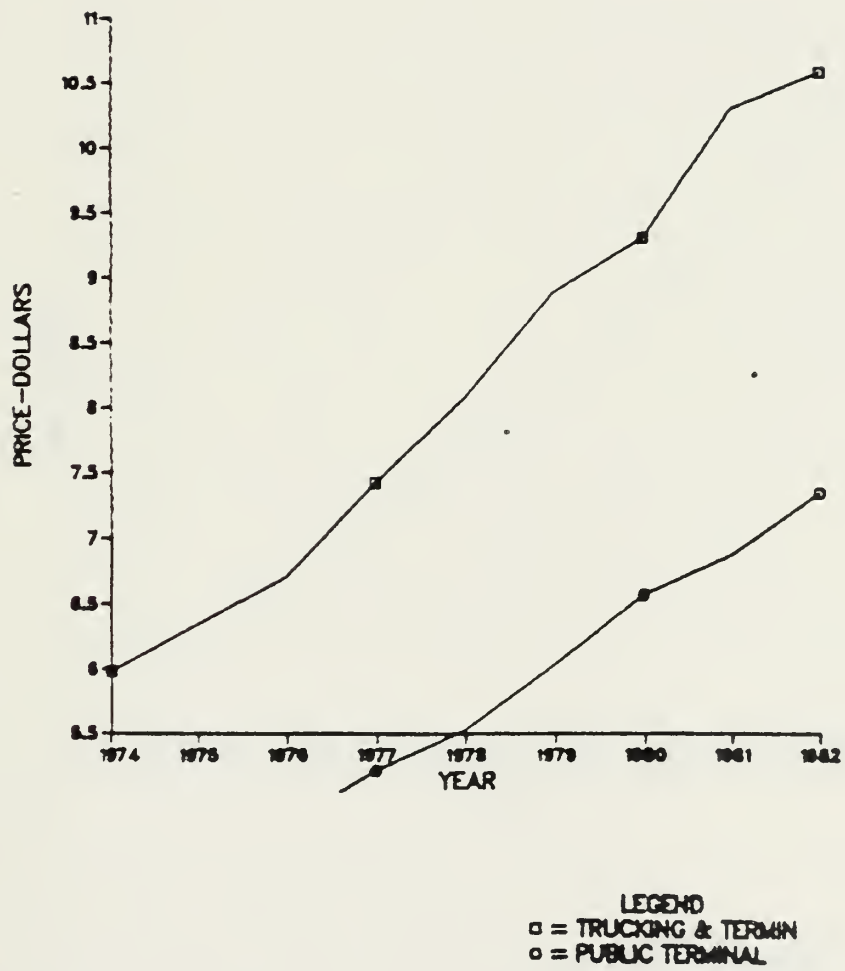
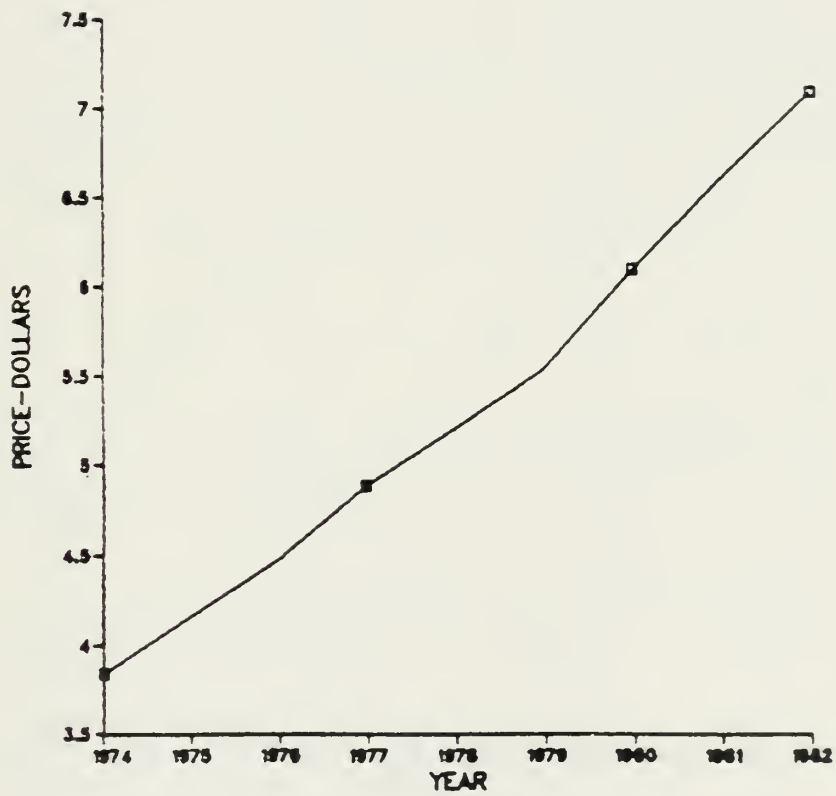




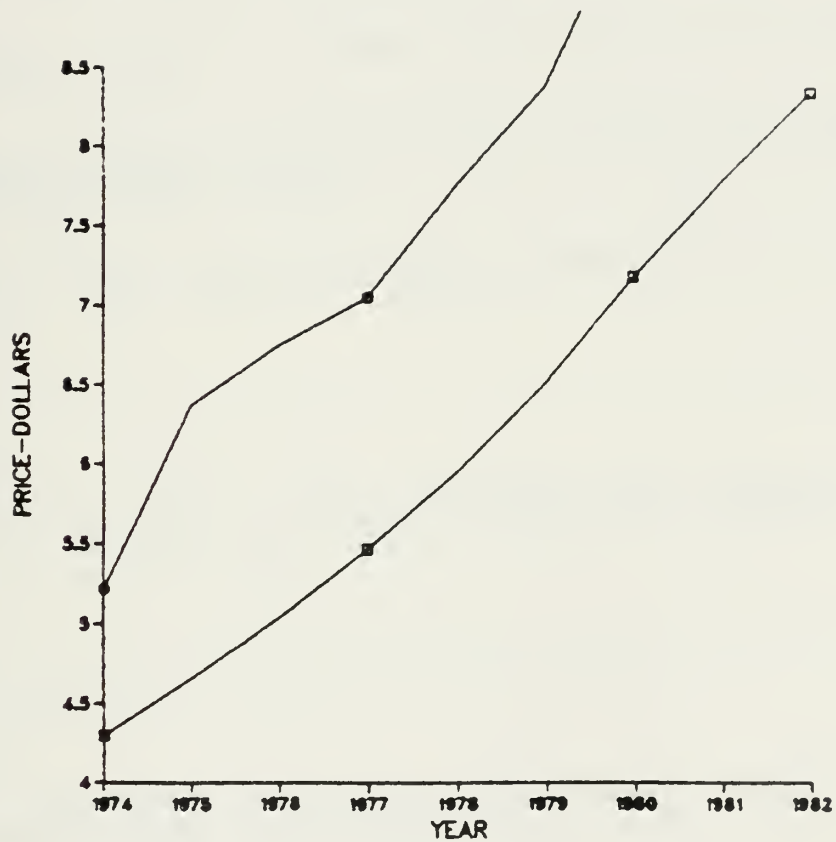
FIGURE C-33 OG20 POSTAL SERVICE LABOR



LEGEND  
□ = BUSINESS SERVICES



FIGURE C-34 OG20 AIR LABOR



LEGEND  
□ = ELECT EQUIP  
○ = AIRCRAFT & PARTS





## LIST OF REFERENCES

1. Wildavsky, Aaron, Budgeting: A Comparative Theory of Budgetary Process, Little, Brown and Company, 1975.
2. Sovereign, Michael G., Budgeting For Inflation, Special Study for Comptroller (OSD), March 1981.
3. Wheelright, Steven C., "Management by Model During Inflation," Business Horizons, V. 18, No. 3, pp. 33-42, June 1975.
4. Katzner, Donald W., Static Demand Theory, The MacMillan Company, 1970.
5. Flynn, Thomas D., "Why We Should Account for Inflation," Harvard Business Review, V. 55, No. 5, pp. 145-157, September 1977.
6. Afriat, S.N., The Price Index, Cambridge University Press, 1978.
7. Ibid.
8. Ibid.
9. Banerjee, Kali S., Cost of Living Index Numbers, Marcel Dekker, Inc., 1975.
10. Ibid.
11. Ibid.
12. Ibid.
13. U.S. Department of Labor, CPI Detailed Monthly Report, Bureau of Labor Statistics
14. Ibid.
15. Ibid.
16. U.S. Department of Labor, BLS Handbook of Methods, Bureau of Labor Statistics, 1976.
17. Ibid.



18. Office of Management and Budget, OMB Circular No. A-11, Preparation and Submission of Budget Estimates, Executive Office of the President, 1982.
19. House of Representatives 97th Congress, "Department of Transportation and Related Agencies Appropriations for 1982," Hearings Before a Subcommittee of the Committee on Appropriations, Government Printing Office, 1982.
20. Ibid.
21. Comptroller, Economic Review Division, Aviation Operating Cost, United States Coast Guard, 1980.
22. U.S. Department of Labor, CPI Detailed Monthly Report, Bureau of Labor Statistics.
23. Earl, Paul, Development of Cost Escalation Indexes for Operation and Maintenance Budget Categories, Data Resources, Inc., 1978.
24. Gorman, Paul R., Composition of Material Price Indices for Operation and Maintenance, Navy Budgetary Account, Master's Thesis, Naval Postgraduate School, Monterey, California, 1976.
25. "Index History, Construction Costs Tracked for US," Engineering News Record, V. 208, No. 11, 1982.
26. Ibid.
27. Thomas, Vincent C., "Today's Coast Guard: A Study in Insufficiency," Seapower, V. 26, No. 9, 1983.
28. Earl, Paul, Development of Cost Escalation Indexes for Operation and Maintenance Budget Categories, Data Resources, Inc., 1978.
29. Ibid.
30. Ibid.
31. Ibid.
32. Gandolfo, Giancarlo, Economic Dynamics Methods and Models, North-Holland Publishing Company, 1971.
33. Ibid.
34. Ibid.



35. Chatfield, C., The Analysis of Time Series, Chapman and Hall, 1982.
36. Coen, P.J., Gomme, E.D., and Kendall, M.G., Lagged Relationships in Economic Forecasting, paper presented before the Royal Statistical Society, London, 15 January, 1969.
37. Department of Transportation, U.S. Coast Guard, Manual of Budget Administration (CG-255).
38. Lennertz, Thomas P., An Investigation of the Forecasting of Aeronautical Price Indexes, Master's Thesis, Air Force Institute of Technology, Wright-Patterson AFB, 1976.
39. Weisberg, Stanford, Applied Linear Regression, Wiley, 1980.
40. Davies, Owen L., and Goldsmith, Peter L., Statistical Methods in Research and Production, Hafner Publishing Company, 1972.



## BIBLIOGRAPHY

- Allen, Roy G., Index Numbers in Theory and Practice, Aldine Publishing Company, 1975.
- Eichhorn, Wolfgang, and others, Theory and Applications of Economic Indices, Physica-Verlag Würzburg, 1978.
- Fisher, Franklin M. and Shell, Karl, The Economic Theory of Price Indices, Academic Press, 1972.
- Geisner, Donald D., Composition of Material Price Indices for Naval Ship Contract Escalation, Master's Thesis, United States Naval Postgraduate School, Monterey, California, 1975.
- Jones, Richard E., A Critical Analysis and Comparison of Selected Models of Inflation, Master's Thesis, Air Force Institute of Technology, Wright Patterson AFB, 1976.
- Morgan, William, F., Aircraft Procurement, Navy (APN) Price Index Study, Center for Naval Analysis, Institute of Naval Studies, 1977.
- U.S. Department of Commerce, Price Changes of Defense Purchases of the United States, Bureau of Economic Analysis, 1979.
- U.S. Department of Transportation, U.S. Coast Guard, Comptroller Manual Volume I, Accounting--Headquarters and District Offices.
- U.S. Department of Transportation, U.S. Coast Guard, Planning and Programming Manual (COMDTINST M16010.1).





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